MECHANICKS MAGAZINE,

AND

Journal of Publick Internal Improvement.

NO. 4. MAY, 1830. VOL. I.

MECHANICKS LIENS.

In our April number, we published the law of 1819, upon this subject, intending to have accompanied it with the following remarks, which, for want of room, we were obliged to defer until this time.

This act, like most others which pass our legislature, though instituted with the best intentions, and doubtless matured by men of wisdom and experience, is ambiguous, intricate, and perplexing. It bears evident marks of having been drawn up by some one person whose intention was to secure the unwary and ingenuous mechanick from falling a victim to the ruinous speculations and rotten fortunes of great *patronizers*, as they have been often called; and it carries no less equivocal indications of amendments made to palliate the objections of Mr. A; insertions to quiet the scruples of Mr. B; and compromises to secure the support of all the rest of the alphabet.

The trivial, and almost unavoidable apparent contradictions in our statutes, would be of little avail if they could be construed by the *common understanding of mankind.* It is an easy thing for us to explain the natural, proper, and general meaning of almost any intelligible clause in our language; it requires no great wisdom, no uncommon experience, to compare the intentions of two contracting parties, signified by them in writing, and in common language, with any written law; but these are not sufficient.

We were obliged, in our revolution, as we have been obliged in every subsequent measure, to compromise. It was an object with the people to prevent, as much as possible, the emigration of rich men at that critical period, when their wealth and influence was all important, and when the prevailing inclination among them was to take refuge in the mother country, from what they apprehended would be not only a political revolution, but the overthrow of all laws, and the destruction of all rights and remedies by which property had been previously held, defended and secured. It required therefore, and was indeed the part of prudence to guarantee the preservation of the civil laws amidst the convulsion of military struggles, and the confusion of political changes.

It is to this cause, rather than to any English predilections or partialities that we trace many of our clumsy customs, and, (as we think,) false notions of the excellence of the English common laws. Because the English law guaranteed a trial by jury, the writ of *habeas corpus*, and the liberty of the press, we were willing to overlook its monstrous, discordant principles of law and equity, (unknown to any other country on earth, excepting our own, which has followed a bad example in this respect,) its aristocratical preference of land over all other kinds of property, and its verbose and wasteful manner of enacting and publishing its statute laws. But of this, more hereafter.

These things being so, we cannot construe our contracts according to common understanding; we cannot put that construction upon them which a majority of the people of this commonwealth would say they bore; much less, the construction which twelve men, taken by lot from among us, would attribute to them. We must construe them as they construe such contracts in England. We must construe them in the manner that English judges say English contracts ought to be construed; and instead of resorting freely to the heart and mind of the parties, we must controul our free inferences by a laboured and pedantick consultation of what has been done at other times in our own, or other countries, and in other cases.

To return to the statute. The object being equitable, and the persons for whose protection it was enacted, being a class entitled, in the cases contemplated by the statute, to peculiar favour, let us examine how the provisions of this law accord with the spirit of the eleventh article of the Bill of Rights. We will also venture to throw

out a few crude, and perhaps mistaken sentiments, upon the *mechanical fabrication* of this law, which we do in the hopes of inviting comments from some source more worthy of attention than any humble effort of our inexperience.

The law professes to establish a new remedy for certain contracting parties, and to do this in such a manner that the rights of third persons shall be secured.

There is in the outset an uncertainty as to the personality of these parties. One party is in the first place called the "*proprietor or proprietors of land.*" This would, to a common understanding, appear certain enough. We are told, however, that it is not so; that "proprietor" may mean the actual owner in fee, or a lessee for life, or a lessee for years, or a mortgagee in possession before foreclosure. He may, therefore, be a very different person from the proprietor of the building. It seems, therefore, that I may let a lot of land to A; he may enter into a contract with a carpenter to build a house on the land leased, by which the carpenter not only has a claim, by him, upon the building, but also has a lien upon my land.

We next find the "*proprietor of land*" assume, in the third section, in two instances, the name of "*the owner of such estate,*" meaning, we suppose, the land and house; but we are again thrown into doubt upon this point, by the fourth section, which calls the same person "*the owner of any lot of land on which a house,*" &c. "*shall be erected,*" &c.

The framers of the statute seem to feel a relief when they get this person, whoever he is, fairly into a litigation before the courts, for in the close of the fourth section they drop all allusion to his rights as owner, leaving that for the court to determine, at the cost of the unlucky loser, and designate him generally by the name of *respondent*, although it does not appear, nor is it a necessary supposition, that he has ever entitled himself to that appellation.

Now for the second party to the contract. He is first described as any person who may enter into a contract with the "proprietor" for erecting or repairing any house, &c. or who shall have furnished labour, &c. These are afterwards called *lien creditors, lien contractor, contracting creditor, and lien contract creditors;* all, no doubt, meaning the same person; but whether it was the intention to embrace the whole community in this law, as is now the case, or whether the legislature intended to secure the mechanick, and that class who are analagous to what are called in the admiralty, *material men*, may be a question. Under the present phraseology, if we may be allowed to judge, the benefit of this lien, which is called the "*mechanicks lien,*" is extended to all contractors, whether mechanicks, who bestow actual labour, and supply stock, or speculators who undertake great jobs on commission.

The security, as has already been shown, if not doubtful, may, at least, be contested with enough plausibility to drive an honest claim to a compromise. The lien is first said to be upon the *building and the lot of land.* It is afterwards called *land and appurtenances;* also, *estate.* But from the sixth section, which contains the important provision of the manner in which the lien shall be discharged, one would certainly be led to suppose that the lien was upon the house or building only, for it makes no mention of land or estate.

Actions, or rather "*legal process,*" must be commenced upon these contracts within six months, and not until the expiration of sixty days after any sum has become due; so that there is in fact, a new statute of limitations made expressly for this act.

With regard to the recording, the last clause of the second section is not only superfluous, but tends to engender uncertainty; the words, "*and have the same effect as recording the whole,*" leave an impression that a portion only of either part of the indenture should be recorded. The recording also of the discharge mentioned in the sixth section, is described in a manner that would create confusion in all cases where legal process was commenced only for an instalment, instead of the whole amount of the lien.

An important query suggests itself to us here. Does this statute give what is called a cumulative remedy or not? Or in other words, does a mechanick, by recording his lien according to this statute, part with his common law remedy? We should be glad of an answer to this question, as we have heard it whispered that before commencing an action at common law, he must abandon his lien.

We should have expected from the title of the act, a much more plain, and a much less expensive and dilatory remedy than the anomalous and heterogeneous "*legal process,*" prescribed in this statute for the "*lien creditors.*" We should have expected that the person for whose benefit the dignity of the English common law had given its stat-

utory nod, would have been allowed to levy execution upon the pledged property by a simple assumpsit action, giving the contract in evidence and left to his own discretion as to interfering with third persons. Instead of this we must draw a petition; notice must be given to the "*owner*," and to all the other lien "*creditors*," by attested copies of the petition, and order of court thereon. This is burdensome. Or the petition and order must be printed in a newspaper. This is no notice at all; and it is doubtful whether a judgment against the owner, on such notice, would be constitutional; and each creditor, it is said, who does not appear, in every case, in consequence of this newspaper notice, "*shall not be entitled to the benefit of such lien!*"

After all this process, if the land and appurtenances are actually sold to pay the "*lien creditor*," the "*proprietor*" has one year to redeem them, by paying twelve per centum; and in the expectation of that usurious bonus the "lien creditor" is left to starve.

We esteem this process expensive, intricate and tedious; but what must the hearing be? Each of the lien creditors shall have a right to contest the claim of the other, by issue to the jury, or otherwise!

First, "*by issue to the jury.*" Here is a bill of interpleader, with twelve men, sitting in the united capacity of vice-chancellors, masters in chancery, and commissioners to take evidence, with the intention of passing interlocutory and final decrees all at once, upon the subject matter before them.

Second, "*or otherwise.*" Upon this mode of trial we do not pretend to offer any remarks.

In case of a prior attachment of the "*estate*," there is to be an appraisal in order (we presume) to prevent the prior attaching creditor from obtaining more of his debt out of the estate than the estate was worth at the time of the attachment. But unfortunately the next section which provides for apportioning the net proceeds of a sale of the estate obliges the officer in apportioning them to pay first the attaching creditors without regard to the appraisal, and to divide the remainder *pro rata* among the "*lien creditors.*" What, then, is the benefit of the appraisal? We ask for information. But even if this appraisal had not been forgotten in the fifth section, and were of some real benefit, we object to it as partial and unjust. Here are several parties interested. First, the owner; second, the attaching creditor; third, the lien creditor. The owner is allowed the privilege of appointing his own appraiser; the lien creditor may also be represented by the person whom he appoints; but the attaching creditor, whether he will or not, must be represented by the "*officer who shall make the sale.*" The officer who "*shall* make the sale," it is said in the next section, may be the sheriff, or his deputy, and, in some cases, the coroner; but what will take place if, during the two or three years, which may reasonably be supposed to intervene between the appraisal and the sale, if the officer who made the appraisal should die? Could the sale take place?

Here again, when the sale takes place, is another notice to be given, and all the tedious formalities required in the sale of an equity of redemption are to be strictly complied with. What are those formalities and what notice is required? We should say a simple deed signed, sealed, witnessed, delivered, and recorded; but here, again, we are left in sad doubt, for there is much probability that the legislature intended, in the fifth section, to require the same notice and formalities which are prescribed by law, when the right of redeeming real estate is sold "*on execution*," and for want of those words, "*on execution*," the whole matter is open to the conjectures and speculations of an intelligent community.

Now who will undertake to blame the makers of this law? Whoever they were, they have furnished us with a statute about as correct as consistent; as intelligible and convenient in its provisions as a majority of those in our books. After a law has passed both branches of the legislature, and has received the governor's signature, it is merely launched into the element of its future career. Before it is really fit for action it must be hauled up into the courts of law, and there wait until the lawyers have rigged it; and then it is not always easy to say whether it is sloop or smack; brig, ship, schooner, or hermaphrodite.

We hope the system may be reformed; not in part, but altogether.

COMMUNICATION.] [FOR THE MAGAZINE.

DEAR SIR,—At your request, I communicate to you, for the committee of the Franklin Rail-Road Company, a stricture on rail-roads. As the most necessary part of our learning, is to detect our errours, I will mention a few erroneous principles under which many engineers labour, though

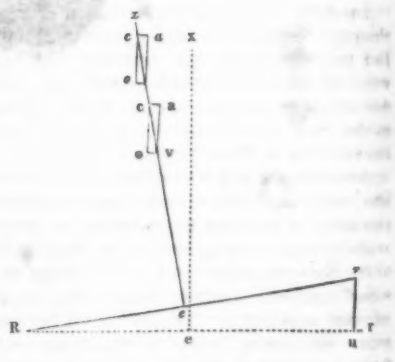
you may be better acquainted with these principles than I am.

Many engineers have asserted, without any exceptions, that, in the conveyance of goods on a rail-way by a locomotive steam engine, the cost of conveyance for a given distance, is the same, whether they are conveyed at a moderate velocity, or at a greater velocity; as, for example, it is asserted, that if an engine, with its complement of fuel and water, weighing four tons, is competent to draw a load of eight tons, including the wagons, (the whole weight of engine, wagons, and load, being twelve tons,) at the rate of seven miles per hour, that by diminishing the load four tons, the engine can draw the remainder at the velocity of fourteen miles per hour, with the same expense of fuel and water, which was required to draw the twelve tons, seven miles per hour. To double its velocity, the whole weight, *inclusive of the engine*, must be diminished one half; that is, it can draw only *two tons*, besides itself, at the velocity of fourteen miles per hour. This will make a very material difference in the cost of transporting goods at different velocities. Hence, by transporting them at a slower speed than is done at present, the cost will be reduced considerably below what it now is. This subject, although of very great importance, has, as I think, been passed over by engineers without the slightest investigation; for, I suppose, any mechanist can convince himself that the former assertion is erroneous, by one minute's reflection, so that, I think, I need not here demonstrate it.

But, there may be, in some cases, one advantage derived from carriages moving at a great speed on an *undulating* road. A carriage, which is moving at the velocity of ten miles per hour, will pass up a rise in the road of three feet, by its force of *inertia*. The height to which a carriage will rise, by this force, is as the squares of the velocities of the carriage; hence, if it move at the rate of sixteen miles per hour, its force of *inertia* will cause it to pass over a rise of eight feet; the horse, or engine, exerting only sufficient force to overcome friction. But such a rise would nearly stop the carriage; it would, however, pass an ascent of four feet, without diminishing its velocity one third. Hence, it will be perceived, that in some cases, a locomotive engine may draw a load at a great velocity, where it could not, at a slower speed.

On curved parts of rail-roads, the outward rail is placed a little higher than the inward one, to counteract the tendency which the carriages have to move in a right line. In Col. Long's Rail-Road Manual, a rule is given, by Lt. Dillahaunty, for determining what this difference of height should be, to be just sufficient to counteract the centrifugal force, or the tendency of the carriages towards the exteriour rail; but the *formula* there given is not correct. I am not aware that any other person has attempted to show how much this difference should be. The proportion from which he deduces his rule, is: "*The elevation or depression of one of the rails, will be to the width between the rails, as the distance between the centres of percussion and gravity, is to the height of the centre of gravity above the rail track.*" Here one principle is used which has not a hundredth part as much influence as is represented; and another, which is impertinent.

If the rails should be of equal height on a curved part of a road, by increasing the height of the centre of gravity of the load, a considerable greater stress *would* be exerted on the exteriour rail. But if the relative heights of the rails are, as they should be, increasing or diminishing the height of the centre of gravity of the load, other things remaining the same, they will have by far too little effect to be noticed, in practice. By diminishing the width of the load, other things remaining the same, the distance between the centres of gravity and percussion, is diminished; yet the tendency of the carriage to run off the road, remains the same.



Let R r, represent the rails, when both are of the same height; then the

centre of gravity of the carriage and load, will be somewhere in the line x e, which is perpendicular to R r, and equi-distant from each rail. Gravity will be in the direction x e, which will be the only force to be noticed on the straight parts of the road, the centrifugal force being nothing at such parts. For a curved road let the rail r, be raised to *r*, then the centre of gravity will be in the line *x e*, which is perpendicular to R *r*, and equi-distant from each rail; and the resultant or combined effort of gravity and the centrifugal force, will be in the direction c *e*, if the rail *r* be of the right height. Suppose the centre of gravity to be at c, and gravity to be represented by the line c o, and the centrifugal force by c a, then the resultant will be in the direction c *e*. [See Farrar's Mechanicks, pages 25 and 26.] Suppose the centre of gravity to be at any other point, as, at *c*; then gravity will be represented by *c* o, which is parallel and equal to c o. A *very small* variation in the centrifugal force, may be produced, by a small diminution in the radius of the curve, described by the centre of gravity of the load. To show what this variation will be in a particular case, we will suppose the width between the rails to be five feet, and one rail two inches higher than the other, (which is as great a difference as will often be needed,) by raising the centre of gravity from three to eight feet above the rails, the radius of the curve described by the centre of gravity, would be diminished by two inches, which in a radius of three hundred feet, would increase the centrifugal force by $\frac{1}{1800}$ part, if the velocity of the centre of gravity should remain the same; a corresponding increase in the elevation of the exteriour rail, will be only $\frac{1}{900}$ of an inch. But the velocity of the centre of gravity will be diminished a little, which will reduce this quantity to less than a ten thousandth part of an inch; a quantity, by far too small to be noticed in practice.

According to a well known law in staticks, when a body is kept on an inclined plane, as *e*, on R *r*, by a force acting horizontally, this horizontal force is to the weight of the body, as *r* u, is to R u; R u, being horizontal, and *r* u, vertical. In the case of a carriage moving on a curved road, R u, will represent gravity, and *r* u, the centrifugal force. It is ascertained that if a body at the surface of the earth, have a horizontal motion of 17,722 miles per hour, its centrifugal force will balance its gravity. Let gravity be represented by the square of this velocity in miles per hour, divided by the radius of the earth, in miles, which will be, omitting fractions, 79,390. Then the centrifugal force of a carriage moving on a curved road, may be represented by the square of its velocity in miles per hour, divided by the radius of the road, in miles: for example, suppose the velocity of the carriage to be twelve miles per hour, and the radius of the road to be $\frac{1}{10}$ of a mile; then $\frac{12\times12}{\frac{1}{10}}=1440$, which is the representative of the centrifugal force; hence, 79,390 is to 1440, as the width between the rails is to the elevation of one of the rails above the other. If the width between the rails be sixty inches, we shall have $\frac{144\times60}{79390}=1\frac{1}{11}$ inches, nearly, for the elevation of one of the rails above the other. Accordingly, we have the following practical rule for determining what difference in the height of the rails, there should be on curved roads:—*Divide the square of the number of miles which the carriages travel in an hour, by the radius of the road in miles; multiply the quotient by the width between the rails, and divide the product by* 79,390. If the width between the rails be taken in feet, the answer will be found in parts of a foot. This rule, though sufficiently exact for all practical purposes, gives the difference a very little too much. I will show how to obtain it exact. By keeping two rails at the same distance, and raising one above the other, their horizontal distance is diminished; that is, the distance R u, is less than R *r*. The difference in the height found by the above rule, to be exact, should be diminished in the ratio of R *r*, to R u. If the width between the rails be five feet, and the difference in their height, two inches, which is as much as will often occur, the true distance between the rails, will differ from the horizontal, by less than $\frac{1}{250}$ of an inch; hence, the result given by the above rule, will differ from what it should be by less than $\frac{1}{1000}$ of an inch; therefore, it is sufficiently exact for all practical purposes.

In some carriages there is another cause of their tending to the exteriour rail; as, when the wheels of a carriage are cylindrical, and made fast to the axles, so that its axles must revolve as the wheels do. Both wheels on the same axletree must, evidently, revolve in the same time; and both being of the same diameter, one cannot *roll* through a greater space, than the

other does in the same time; this will give the carriage a tendency to move in a right line, or to run off the road, where it is crooked. When such a carriage changes its direction, one wheel must move a greater distance than the other does in the same time; therefore, it must slip on the rail. This may be remedied by making a part of the tire conical, and placing the rails so far apart as to give the flanges some play between them.

Many authors have mentioned, that the rails of the curved parts of a road, suffer a greater stress than at other places. But none of them, which I have read, have investigated this subject theoretically. I endeavour to supply this desideratum in some measure.

Let c o, represent gravity, and c a, the centrifugal force, then c v, will represent their resultant. [Farrar's Mechanicks, pp. 25 and 26.] When the relative heights of the rails are adapted to the bend of the road, and the velocity of the carriages which travel on it, the triangle c o v, will have its sides perpendicular, respectively, to the sides of the triangle R u *r*, consequently they are similar; therefore, R u, may represent gravity; *r* u, the centrifugal force, and R *r*, their resultant, which will be the force exerted on the rails. The width between the rails R *r*, and the difference in their height *r* u, being known, the distance R u is easily found. Suppose the width between the rails to be five feet, and the difference in their heights two inches, which, as before observed, is as great a difference as will often be needed; then the line R *r*, will differ from R u, by less than $\frac{1}{1740}$ part; hence, the force exerted on the rails at such places, is not one thousandth part greater than on the straight parts of the road. But if the heights of the rails be not adapted to the bend of the road, and the speed of the carriages which move on it, the flanges may rub the rails, forcibly, and the load may bear much harder on one rail than on the other. *This* is the cause of the rails and carriages being broken at such places.

If carriages be required to pass very crooked roads, with very different speeds, a different set of rails will be needed, at such places, for each speed. But if the radius of the road be great, or the velocities differ but little, one set of rails will suffice for both velocities.

Many other causes have a *very small* effect on the pressure of carriages on the rails; but, perhaps, no more of them are worthy your attention.

Your most obedient
And humble servant,
URIAH A. BOYDEN.

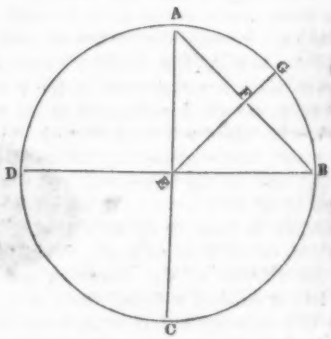
Mr. Andrew J. Allen.
Cambridgeport, March 31, 1830.

COMMUNICATION.] [FOR THE MAGAZINE.

MR. EDITOR,—I send you a method of finding the circumference of a circle. It is from a London work, and may be found in the American Mechanicks Magazine, Vol. 1, p. 105, New-York, 1825.

"Divide any given circle into four equal parts, A B C D; draw a line from A to B; divide the quarter of the circle, A B, in half, E G. Now, three times A C, and once F G added thereto, gives the length of the circle A B C D within the 1-4000th part of the said circle. A less angle would, of course, give a greater approximation, but would be less easy to the uninformed artisan. In words the fact might be stated thus:—

Three times the diameter and the versed sine of the angle 45° gives the circumference within the 1-4000th part."



I have no doubt but the above method may be of service to the mechanick. It appears to me, however, that the circumference found in this way, is not so near the truth as stated; being rather surprized at the remarkable accuracy attained, I examined it, and found that if the diameter of a circle be 206, the circumference by the above method will be 648.168
and by the true method, ... 647.168
To ascertain which, I took the following method, supposing the diameter to be one:

3.50000000	three times A C, and once E G,
0.35355339	E F, subtracted,
3.14644661	3 times A C, and once F G, which
×206	is the circum. by this method.
1887867966	
629289322	
648.16800166	circumference; one unit greater than the truth; diameter being 206.
3.14159265	true circum.; diameter being one.
×206	
1884955590	
628318530	
647.16808590	true circum.; diameter being 206.

It now remains to show how the length of the line E F, was found.

It is known to most persons, moderately versed in geometry, that "in every right angled triangle, the two squares formed upon the base and perpendicular, are, together, equal to the square formed upon the hypothenuse." By the help of this problem we shall be able to find the length of E F.

We have supposed A C, to equal one, of course the right angled triangle, A E B, will have its base and perpendicular, each, equal to half; the square of half is one fourth, thus:

.5×.5=.25 square of base,
.5×.5=.25 square of perpendicular,
=
.50 sum of the two squares, which is equal to the square formed upon A B.

The sqr. rt. of .50=.707106781 &c. length of A B, this divid. by 2 gives .35355339 length of A F, F B, and E F; these three lines being all equal; this, I think, will be evident to any person, by inspection.

From which, it appears, that three times A C, and once F G, added thereto, gives the length of the circle A B C D, within the 1-648th part of the circumference, or 1-206th part of the diameter; and not 1-4000th part, as stated above.

I have been thus particular, from a love of truth, and because arithmetick and geometry are the foundations of all mechanical pursuits. If I am wrong, I hope some one will set me right. T. C.

A subscriber, from Plymouth, asks the following questions:

Plymouth, March 30th, 1830.

Mr. Editor,—Sir, one of your subscribers would like to know if the building of chimneys is considered one of the mechanick arts; if so, is there any rule or method by which a chimney may be built to carry smoke with certainty? If there is, I consider it very important that it should be known, especially in this part of the country; for I know of a great many good, convenient new houses, and yet nobody can live in them for smoke; at least, I could not; or are a smoky house and scolding wife inevitably to be considered matters of luck and chance? Any information upon the subject will be gratefully received by A Subscriber.

A correspondent has timely furnished us with the following scientifick article upon smoky chimneys. We hope our *subscribers*, and the publick generally, may derive much benefit from the observations made by our intelligent friend.

P. S. For the latter evil, we believe it to be one of those *luck and chance* afflictions wherein the "patient must minister unto himself;" therefore, any prescription from us would be unnecessary.

It is indispensably necessary to those who engage in the construction and improvement of fire-places, or who are desirous of forming just ideas relative to the operation of fire, and the management of heat, that the cause of the ascension of smoke should be well understood.

It is not easy to determine the precise period when chimneys were first used. It has been urged against their antiquity, that if there had been any in the houses of the Romans, Vitruvius could not have failed to describe their construction; but he says nothing on the subject; neither does Julius Pollux, who collected, with great care, the Greek names of every part of a dwelling house. The oldest certain account of chimneys, that has reached us, is an inscription at Vienna, which records, that in the year 1347, a great number of chimneys were thrown down by an earthquake.

We infer that there were no chimneys in England and France until the fourteenth century; for the writers of that period seem either to have been unacquainted with them, or to have considered them as the newest inventions of luxury. History intimates, that previous to this the people kindled fires in their houses, in a hole or pit in the centre of the floor, under an opening formed in the roof, and when the fire burnt out, or the family went to bed at night, the hole was shut by a cover of wood.

Until the last century the construction of chimneys has been but little understood. Dr. Franklin, in 1785, published his observations on the "Cause and Cure of Smoky Chimneys," and was the first who wrote on the subject, treating it in a philosophical manner. Since then, Count Rumford published his essays, in which the same subject is treated. These two works contain much valuable information on the subject of chimneys.

The mode and cause of the ascent of smoke in a chimney, may be thus explained: the air in the flue being heated by the fire immediately below it, becomes rarefied, and therefore, lighter than the external air through which it accordingly ascends; and as the heated air escapes from the top of the chimney, its place is supplied by the influx of a fresh quantity of air from below, which, passing over and through the fire, becomes likewise heated; and thus, a constant current is formed in the flue, which directs and carries off with it, the smoke and vapour from the burning material.

It is to be observed, that smoke is not, as might be supposed, in its own nature, specifically lighter than air; but the contrary, as may be shown by a simple experiment. Light a pipe of tobacco; plunge the stem to the bottom of a decanter, half filled with cold water; then putting a cloth over the bowl, blow through it, and make the smoke descend in the stem of the pipe, from the end of which, it will rise in bubbles through the water, and being thus cooled, will not afterwards rise to go out through the neck of the decanter, but will remain, spreading itself and resting on the surface of the water. In this case, then, smoke is heavier than air, and it is only when rarefied by heat, that it becomes lighter. As the vapour, rising from a fire, must always be highly rarefied, it is easy to perceive, it would be as much a miracle if smoke should not rise in a chimney, (all hindrances to its ascent being removed,) as, that water should refuse to run in a syphon, or to descend in a river.

What is it, then, which creates a smoky chimney, that is, one which instead of conveying off all the smoke, discharges a part into the room? In answer to this inquiry, the following general causes may be adduced:—

Smoky chimneys, in a new house, are such, frequently, for want of air. The workmanship of the rooms being all good, and just out of the workman's hands, the joints of the flooring, and the pannels of the wainscoting, are all true and tight; the more so, as the walls, not yet being thoroughly dry, preserve a dampness in the air of the room, which keeps the wood-work swelled and close. The doors and sashes, too, being worked with truth, shut with exactness, so that the room is perfectly tight, no passage being left for the entrance of air except the key-hole, and even that is often closed by a little dropping shutter. Under these circumstances it is evident there can be no regular current through the flue of the chimney; as any air escaping through its aperture would leave a vacuum in the room similar to that in the partially exhausted receiver of an air pump, and, therefore, an equal quantity of air would rush down the flue to restore the equilibrium; accordingly, the smoke, if it ever ascended to the top, would be beaten down again into the room.

Those, therefore, who close every aperture in the room, to prevent the admission of fresh air, and still would have their chimneys carry up the smoke, require inconsistencies, and expect impossibilities.

The obvious remedy in this case is, to admit air; and the question will be, how and where the necessary quantity of air from without can be admitted with least inconvenience. If the door or window be left much open, it causes a draught of cold air towards the fire-place, to the great annoyance of those who sit there.

Various have been the expedients to avoid this evil, such as bringing in fresh air through pipes in the jambs of the chimney, pointing upwards to give the smoke the same direction, or opening passages into the funnel above, to let in air for the same purpose. But these produce an effect contrary to that intended; for, as it is the constant current of air passing through the opening of the chimney into the flue, which prevents the smoke from coming out into the room, if the funnel be supplied, by other means, with the air it wants, and especially, if that air be cold, the force of the current is diminished, and the smoke, in its efforts to enter the room, finds less resistance, it is indispensable that a current of air be admitted into the room to supply the place of that which is constantly passing up the chimney; and it is advisable to make the aperture for its admission as near the ceiling as possible, for the heated air of a room naturally ascends and occupies the highest part of the room, thus causing a great difference of temperature at different

heights; a defect which will be in some measure obviated, by admitting the cold air near the ceiling, which, descending, will beat down and mingle with the warm air.

Another cause of smoking chimneys, is the shortness of the flue. In this case, the ascending current will not always have power sufficient to direct the smoke up the flue. This defect is often found in low buildings, and in the upper stories of high ones, and is unavoidable; for if the flue be raised high above the roof to increase the draught, it is in danger of being blown down, and crushing the roof in its fall. The remedy, in this instance, is to contract the opening of the chimney, so as to cause all the air, entering, to pass through, or very near the fire; by which means, it will be considerably heated, and by its great rarefaction, cause a powerful draught, which will compensate for the shortness of the column.

The case of too short a funnel, is more general than would be imagined, and is often found where one would not expect it. In ill contrived buildings it is not uncommon, instead of distinct flues for each fireplace, that the funnel of an upper room is bent and turned into a funnel coming from below; by which, both flues are shortened. The cold air will ascend in the flue which has no fire, being partially heated by the flue which has the fire; consequently, the draught is weakened. The most easy remedy is to stop the fire-place of that flue which is not in use.

Another very common cause of smoky chimneys is, their overpowering each other. For instance, if there be two chimneys in one large room, and a fire be kindled in each, it will be found, that the greater and stronger fire will over-power the weaker, and draw air down its flue to supply the demands of the stronger, and the air, in its descent, will drive down, and force the smoke into the room. If, instead of being in one room, the chimneys are in two different apartments communicating by a door, the effect is the same whenever the door is open.

The remedy is, to take care that each chimney have the means of supplying itself with air from without, so that one may not be obliged to borrow from another, or be under the necessity of lending.

When chimneys are situated so as to be commanded by higher buildings, or a hill, the wind, blowing over such eminences, will fall, like water over a dam, sometimes almost perpendicularly on the tops of chimneys, in its way, and beat down the smoke.

There is another manner in which chimneys are commanded; the reverse of that last mentioned. It is when the commanding eminence is further from the wind than the chimney commanded. For instance, suppose the chimney of a building so situated, that its top is below the level of the ridge of the roof, which, when the wind blows against it, forms a kind of dam to its progress. Under these circumstances, the wind being arrested in its course by the dam, will, like water, press and search for a passage through it; and finding the top of the chimney below that of the obstruction, will force itself down the funnel, to find a passage through some door or window on the other side of the building; and if there be a fire in such chimney, its smoke is of course carried along with the current of descending air into the room.

Chimneys, otherwise drawing well, are sometimes made to smoke in consequence of placing a door in an improper situation. When the door and chimney are placed on the same side of a room, if the door opens from the chimney, a current of air from it, when partially open, directed across the opening of the chimney, will frequently draw out some of its smoke.

A room, having no fire in its chimney, may sometimes be filled with smoke, which is received at the top of its funnel, and passes down into the room. To understand this, it will be necessary to observe, that currents of air are frequently produced in flues which have no fire in them. The air in the funnel being confined on every side by brick-work, which is a bad conductor of heat, will not be immediately affected by any sudden variation in the temperature of the atmosphere; and thus, while it differs in weight from the external air, an ascending or descending current will be formed in the flue.

If after a warm season, the external air suddenly grows cold, the rarefied air in the chimney will force itself upwards; cool air rushes in to supply its place, which being rarefied, in its turn rises; and this operation continues till the funnel grows cooler, or the external air warmer, or till both are affected, when the motion ceases.

On the other hand, after a cold season, if the external air becomes suddenly warm, the operation is reversed.

When the temperature of the atmosphere and the flue is nearly equal, the different

temperatures of day and night, are sufficient to produce these currents. The air begins to ascend the funnel, as the cool of evening comes on; and this current will continue till, perhaps, nine or ten o'clock, next morning, when it hesitates as the heat of day approaches, and at length sets downwards, and continues so till towards evening, when it again hesitates for some time, but finally goes upwards, during the night, as before mentioned.

Now when smoke, issuing from the tops of neighbouring chimneys, passes over flues whose currents are setting downwards, as they often are in the middle of the day, the smoke is of necessity, drawn down those funnels, and descends, with the air, into the chamber or other apartments.

Chimneys which draw well in calm weather, may, nevertheless, sometimes throw the smoke into the room in consequence of strong winds passing over the tops of their flues, though not descending from any commanding eminence. To illustrate this, it may be considered, that the ascending light air, to obtain a free issue from the funnel, must push out of its way, or oblige the air that is over it to rise.

The simplest and best remedy in this case, is the application of chimney pots.

This subject will be continued in some future number.

COMMUNICATION.] [FOR THE JOURNAL.

RAILWAYS WESTWARD.

It may be presumed that there is no doubt in the minds of the inhabitants of this city, concerning the necessity of some new and improved means of intercommunication between the town and country. Nor are there many, who doubt of the superiority of railways, for our climate and circumstances, over every other mode of transportation. We are all conscious that business of every description, would be immediately increased by this improvement; because we know that the consumption of the articles of our foreign trade, and manufactures, would be increased by a diminution in the cost of transportation; and from the same cause, an increased consumption of the produce of the country, would take place in the city. The increased demand for one and the other, would necessarily cause an increased supply; hence, the expectation of an immediate increase in business seems as reasonable as to expect any given effect from a known cause.

Admitting the premises, viewing the stagnation of business, and knowing that the means of obtaining the proposed improvement are in our power; in other words, that money is plenty and cheap, it may be pertinently asked, why do we forego any longer the benefit of an enterprize so easy to be accomplished? I will answer this question in the only way which seems to me reasonable. We are divided on a subject of very little importance to this city; that is, on the precise location of the road. It may be of some importance to certain towns and counties, but not much to the city, provided it go westward. Many plausible speculations may be made, and probably have been made by the advocates of the different routes, and perhaps, based, too, on very elaborate statistical arguments. But if there be one argument better than another in this case, it would be that one, which should show to us the best income for the route, and the speediest return for our labours. Nothing will so effectually bring railways into favour, as the success of the first.

As Bostonians, I should think then, that it were expedient for us to sacrifice every minor consideration and partiality to the main object of a railway westward. Let it be understood, if you please, that the first thirty or forty miles shall be in a direction which will admit of branches towards two points on the Connecticut river, sufficiently distant to embrace the views of both parties; and that this location shall be determined by the subscribers of stock, as soon as the requisite sum shall be subscribed, and the first instalment paid.

There can be no doubt that the required amount would be immediately raised, provided that those by whose means the enterprize is to be accomplished, saw some reasonable prospect of its being carried into effect speedily, and in a manner that would comport with their interests as stockholders and as citizens.

A railway westward, is what the citizens desire; some want it a little more to the south, and others, a little more to the north; yet, all reasonable men, having the major interest uppermost in their minds, would be willing to subscribe for a western railway, leaving the precise location to the choice of a majority of stockholders.

I would respectfully propose, then, to the respective parties, to unite forthwith, and

obtain subscriptions for a western railway, under one or both of the charters issued; or prospectively, for one to be asked for at the next meeting of the legislature.

UNION.

COMMUNICATION.] [FOR THE JOURNAL.

RAILWAYS AND CANALS.

In my last, I presented a few facts and circumstances in relation to internal improvements in Maine, New-Hampshire, Vermont and Massachusetts.

CONNECTICUT.—Enfield canal, at Enfield Falls, on the Connecticut river, is five and a half miles long. This canal was completed last fall. It has three stone locks, each ten feet lift; ninety feet by twenty. It is four feet deep. This canal adds forty miles to the steam boat navigation of the Connecticut; and if no other measures for internal improvement were to come in competition with it, would, in all probability, prove profitable to its enterprizing constructors, and of great general utility and importance to the valley of the Connecticut. The enterprizing spirit of its inhabitants, manifested in the improvement of the navigation of this river, is highly honourable to them; and it would be a subject of deep and general regret if any of the measures for such a laudable object should prove otherwise than profitable. I am not informed as to the toll, per ton, paid for goods at this canal. From thence to Greenfield, it is one dollar and ninety cents. The tolls on the rail-road from Connecticut river to Boston, will probably, be no more than two dollars; and there is a less resisting medium to be overcome on a rail-road than in the river. The distance from Springfield to Long Island Sound, is about the same as to Boston, and fifty miles more from Deerfield. The time occupied on the river is twice or three times as long as it would be on the rail-road. When at the ocean, goods must be shifted into a sloop, and be subjected to the expense, hazard and delay of about two hundred miles more of water transportation, and when arrived at New-York, are not at so good a market as Boston. Nothing, therefore, can be more certain, than that the construction of a rail-road from Boston to the Connecticut, at any point, must render its navigation, however much improved, of very little value.

FARMINGTON CANAL, commences at New-Haven, and is so far completed as to be navigable to Westfield, and considerable progress has been made between that place and Northampton. It has five hundred and twenty feet lockage, and cost about $11,000 per mile. Its projectors expected that it would ultimately be extended from Northampton along the valley of the Connecticut, through Massachusetts and Vermont, to the lake on the Canada line; become a substitute for river navigation, and make New-Haven, instead of Hartford, the commercial outlet for that extensive and fertile territory. That it would, under such circumstances, have maintained a successful competition with river navigation, there can be little doubt, as it is not only a cheaper, but speedier and safer kind of transportation. But if the doctrine that rail-roads are superiour to canals, which seems now to be a well settled fact among the scientifick and experienced, is sound, the value of this canal must depend very much on the result of the effort now making for the construction of a rail-road from Boston to the river.

RHODE-ISLAND.—Although the largest part of the Blackstone canal is within the limits of Massachusetts, it would have been more proper to have spoken of it as a Rhode-Island canal, as we were principally indebted to Rhode-Island enterprize for its construction. Something like nine tenths of the stock, I believe, was taken by the citizens of that state.

NEW-YORK.—Erie canal, extends from Albany to Buffalo, and connects the Hudson river with lake Erie; is three hundred and sixty-two miles long; sixty feet wide at top; forty at bottom; four feet deep; eighty-three locks; six hundred and eighty-eight feet lockage; cost $7,602,092; tolls in 1827, $859,058.

CHAMPLAIN CANAL; from Albany to Whitehall; connecting Hudson river with lake Champlain; lockage, one hundred fifty-three and a half feet; toll, 1827, $72,833; navigable on an average, about seven and a half months in a year.

Should the Brattleborough rail-road pass through Vermont, and connect with another from Ogdensburgh, the value of this canal would be very much diminished.

SENECA CANAL, extends from Geneva to Montezuma; connects Seneca and Cayuga lakes with the Erie canal, and is 20 miles long.

OSWEGO CANAL; from Oswego to Syracuse; connecting lake Ontario with the Erie canal; thirty-eight miles long; one hundred and twenty-three feet lockage. All descending towards lake Ontario.

Delaware and Hudson Canal; extends from Carpenter's Point to the Hudson, four miles below Kingston; connects the Hudson and Delaware rivers, and unites with the Laxawaxen canal, in Pennsylvania. Length, sixty-five and a half miles; thirty-two feet wide at top; twenty at bottom, and four feet deep. This canal was constructed partly at state expense, and partly by individual enterprize.

An act has passed the New-York legislature, authorizing the construction of a rail-road from Ithaca, near the south end of Cayuga lake, to the Susquehannah river, on the Pennsylvania line. It is calculated that when this road is completed, a barrel of pork may be delivered, by the way of Susquehannah river, through Pennsylvania to Baltimore, at from fifteen to twenty cents less than the present cost of conveyance by the Erie canal to New-York. This calculation, however, is more than doubtful.—The distance may be less to Baltimore, but the obstructions to the navigation of the Susquehannah, must necessarily be of a very serious character, and the occasion of much delay, danger and expense.

An act has also passed, authorizing the construction, at state expense, of a canal from the south end of Seneca lake to Elmira, on the Chemung river, (a branch of the Susquehannah,) provided it can be done at an expense not exceeding $300,000; and Crooked lake canal, also, provided the expense does not exceed $120,000, leading from Crooked lake to a branch of the Susquehannah.

Strenuous efforts have been made for some years to unite the Erie canal with the waters of the Susquehannah. Like the project for the construction of a rail-road from Boston to the Connecticut, it is universally felt to be a matter of great importance, but local feeling and interest having designated several routes, publick sentiment cannot be made to fix upon any one of them.

A bill was before the New-York assembly for a canal from Port Plain, on the Erie, to Otsego lake, Tioga and the Chemung narrows, equal to about two hundred miles of continued navigation.

The facilities for canaling in New-York, are probably superiour to those of any other state, if we except the low level parts of the southern states; and the manner in which these great works were laid out and pursued to completion, exhibits a very intelligent and judicious course of management. About six hundred miles of canal are now in complete, successful, and profitable operation. Nearly five hundred of this, was constructed entirely at state expense; as was also a considerable portion of the remaining one hundred. The state is now deriving an income of about seven per cent upon the whole of these investments.

The rise of property fairly attributable to these canals, in the cities of New-York, Albany, Troy, Utica, Rochester, Buffalo, and many others, is immense. The spur which was given to business generally, by the expenditure of this capital throughout the interiour of that state; the increased value which was given to surplus land, produce and labour, (in fact, by producing demand, it has given value to many articles which had none before,) it has added to the wealth of this commonwealth to an incalculable extent.

This increase has been estimated (by a gentleman as well qualified to make such an estimate as any man could be,) at one hundred millions of dollars; and all the direct and indirect pecuniary benefit which has been realized by the citizens of that state; all the high respectability which she has gained abroad; and her vastly increased influence and weight in the councils of the Union, have been secured by the expenditure of only about thirteen millions of dollars.

Middlesex.

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communication.] [for the magazine.

Mr. Editor,—In the number for February, there is a description of a sess-pool to receive the sediment from the drains, and preventing the effluvia from passing. So far as regards the forming sess-pools for the mud in the street drains, it is very good, as it can be taken out at the openings; but if every cellar or sink drain is to be provided for, by having an opening from the surface of the ground, to a foot and a half below the bottom of the drain, (a depth from six to ten feet, as the case may be,) and large enough for a man to work in to remove the deposit, I am afraid that individuals will rather put up with the inconvenience, than incur such an expense.

There is a much easier and less expensive method of constructing places for the sediment, and preventing the foul air from passing into the cellar, which I have seen, and which I will attempt to describe. The sess-pool is made at the mouth of the drain, about one foot deep and two feet long, that

is, one foot in towards the drain, and one foot in the cellar, the width according to the width of the drain.

It is evident that the dirt will settle in the hole, and the clear water pass off; then, to keep out the rats and stench, a piece of old cast-iron, or piece of slate should be secured in the opening, and pointed, air tight, with Roman cement; the lower edge of which must reach into the water.

Thus, the passage of foul air is prevented, and the place can be cleared of the sediment without any difficulty. The cost of such a contrivance, if made with bricks, does not exceed three dollars; and it will be surprizing, if after knowing this, people will suffer such an abominable nuisance from the common sewers, when it can be avoided at such a trifling expense.

The hollow plug and log answers well, but it is a great deal more expensive and difficult to be fixed, where the cellar is finished and the ground filled in outside.

The common method of conducting pump, sink, or yard drains into the main drain, without any place for the sediment to fall into, leads the city and individuals to a prodigious expense, besides keeping the streets in confusion, as we see, every summer.

Unimportant as this subject may appear, the consequences amount to thousands of dollars yearly, which might, in a great measure be saved, if owners of estates would attend to the following simple directions in fixing the upright part of the drain which takes the water from the shoe of the pump; or the water from yards where it is let off by going into the drain.

The upright should be about five feet deep and 18 inches square inside, in order to clean it out easy; and the outlet about two feet from the top of the ground, and near one corner of the box, or upright; a hole four inches square is large enough.

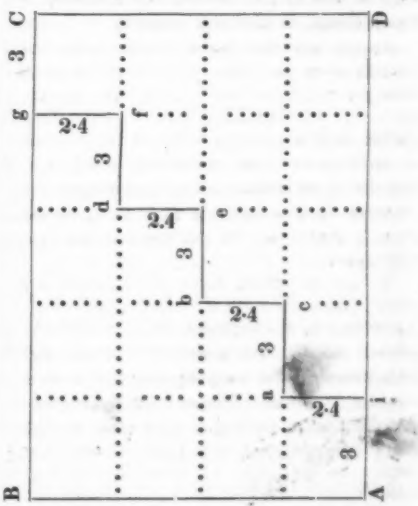
Thus, the sediment will fall to the bottom instead of going into the drain. At the corner where the hole is, (if the upright is made with bricks,) a piece of slate may be worked in, in such a manner as to take up as little room as possible; the lower edge of which, should be about two inches lower than the bottom edge of the outlet, or where the water will stand. This will prevent the disagreeable smell from the drain, and will make it necessary to clean the dirt out as often as it rises to this height.

Sink drains should lead into a place of this kind, before the water is allowed to pass into the main drain.

Grates and strainers will do much towards keeping hard substances from going into drains, but people are apt to be careless about them, and they soon get knocked away; but here is a cheap, self-acting contrivance, which cannot fail to answer the purpose for which it is intended. B.

COMMUNICATION.] [FOR THE MAGAZINE.

Mr. Editor,—In looking over my last London M. Magazine, I found three or four solutions of a question proposed by a Mr. Lucock. The case is this: a box, exactly 12 inches square, having lost its lid, it is proposed to make a new one out of a board 9·6 inches by 15. Each of the methods are demonstrated with engravings. After a little reflection upon the question, it struck me that the lid required might be obtained in a much more simple manner than either of the methods proposed, and the following is the result of my inquiries:



Let ABCD represent the board 9·6 inches by 15 inches; divide AB into 4 equal parts, each of these parts =2·4 inches. Also divide AD into 5 equal parts, each of these =3 inches. Through these points of division, draw lines parallel to AB and AD, as shown in the figure. Through the points g, f, d, e, b, c, a, i, where these lines intersect each other, draw the lines gf, df, eb, &c. The rectangle will then be divided into two equal parts, BgfdebcaiA, CDiacbedfg. Let the part CDia, &c.

be brought down so as to make the line gc coincide with df, and gb with dc, ac with Ai. Then it is evident that we shall form a square, for AB+ai=9·6+2·4=12 inches, and BC—gc=15—3=12 inches.

The editor of the Magazine observes:—"the shortest must, of course, be the preferable method of solving this problem; that is, the fewer cuts, and the fewer pieces, the better. Mr. Lucock employs two cuts in the first of his methods, but the result is four pieces. None of our correspondents, who have favoured us with solutions of this case, have proposed to use fewer than four cuts; one requires six, another nine."

MECHANICKS

APPRENTICES LIBRARY.

This highly useful institution was formed, June 19, 1828. It is located at present, at No. 2, Congress square, and is open on Tuesday and Saturday evenings, for the delivery of books. It contains upwards of 1,700 volumes of books, in the various departments of divinity, history, geography, voyages and travels; and, also, a few volumes of light reading.

Some inconvenience may have arisen, (the library being open only at these periods,) to those who were disposed to make donations of books to the institution; hence, it was thought that to have some place which was open through the week, would best promote the interest of the institution; whereby all, who were so disposed, might transmit their books, or leave word where they might be sent for, when they would be sent to the librarian, and suitable acknowledgment of their receipt, accompanied by a vote of thanks, transmitted to the respective donors. The introduction of the following vote in this place will show that the object is thereby provided for; and an invitation is hereby most respectfully given to the publick in general, to let the subject have a place in their minds, and if, at any time, an opportunity should be afforded them of serving the interests of the library by a donation of such books as may be esteemed by them to be useful, they will be promoting the interests of a numerous and valuable class of our youthful fellow citizens; they will be furnishing them with the means of advancing their intellectual acquirements, which, in future years, may return to them in the richest of blessings.

Resolved, That the government of the Apprentices Library Association, highly approve the proposal of Mr. S. N. Dickinson, of making his office a place of general deposit for donations made to their library; and also thank him for the proposal, which they think will be highly beneficial.

COMMUNICATION.] [FOR THE MAGAZINE.

Sir,—I observed, on reading a publication in the Boston Courier, of Wednesday, 7th ult. in regard to the Mechanicks Magazine, that the editor of that paper advanced a *query* respecting the words *rotary* and *rotatory*. As a great number of our steam engine builders in this, and other cities of the Union, may not, perhaps, know which is the most proper term, I have been at some pains to consult the various authors on steam, in regard to it. Tredgold, in his work on the steam engine, and which is generally considered the best on the subject, almost universally uses the word *rotary*; very seldom, the words *rotative* and *rotatory*. About the year 1787, Mr. Watt applied the sun and planet wheels, and other improvements, to his steam engine. This he calls his "Patent *Rotative* Steam Engine;" and it is the only application of the word *rotative*, so far as I can learn, to an engine using the beam, crank, and fly wheel. Stuart, in his "Descriptive History of the Steam Engine," whilst treating on those which are worked without the intervention of the piston and lever beam, always calls them *rotatory*, or *rotative* engines. I cannot perceive that the word *rotary* is used once by him in the course of his work. Partington, and other writers which I have examined, all concur in using the words *rotatory* and *rotative*.

In Webster's Dictionary, may be found the following definitions:

"*Rotary*.—Turning as a wheel on its axis, as rotary motion.

Rotatory.—Turning on an axis as a wheel; rotary. Going in a circle; following in succession as *rotatory* assemblies. This word is often used, probably by mistake, for *rotary*. It may be regularly formed from *rotator*, but not with the exact sense in which it is used; with *rotator* for its original, it would signify *causing*, rather

than *being* in circular motion. The true word is *rotary.*"

I do not find either of these words in the "*Dictionarium Brittannicum,*" which was published in 1730, before an engine of this kind was ever thought of; therefore, I think they must have been coined since that time. Now, sir, as all terms which have been in general use for a long while by mechanicks and practical men, become legitimate in any language, and as we are bound to use the shortest and easiest of pronunciation, I can have no hesitation in declaring *rotary* to be the most fit and proper term.

R. H. E.

STEAM FIRE ENGINE.

Shortly after the conflagration broke out, to which the Argyle-rooms fell a prey on Friday last, a new fire engine, worked by steam, on the same principle as "The Novelty" steam carriage, and manufactured by the same ingenious and enterprizing engineer, made its appearance on the scene, under the direction of Mr. Alfred Braithwaite, and earned for itself universal admiration, by the powerful services which it rendered on the occasion. It was worked incessantly for nearly five hours: discharged upon the burning pile and adjacent buildings from thirty to forty tons of water per hour: and sent its jet of water completely over the dome of the building, a height of at least eighty feet. We have seen it stated in some of the newspapers that none of the engines was able to reach the dome; but this statement can only be correct as regards the old engines. Several gentlemen, who were present at the fire, have assured us, that they saw distinctly the water ejected from Mr. Braithwaite's engine quite over the dome; and one of the same individuals previously witnessed a private trial of the engine, when it threw water over a pole ninety feet high, erected for the purpose of the experiment. The expenditure of fuel to produce these wonderful effects was only about three bushels, during the whole five hours; and the help of *two* men only sufficed to keep the steam up, and superintend the working of the engine.

In all that regards the generation and application of the steam, the same contrivances are adopted in this engine as in "The Novelty;" but there is a difference in the form of some of the parts, and in the general arrangement. The furnace and boiler, are exactly the same as those of "The Novelty," but of less power. The hot air-pipe, instead of being vertical, has received a serpentine form, which adds much to the appearance of the engine in point of elegance and compactness. This pipe has also been made to turn on a swivel, so that the engineer or driver of the carriage can turn the mouth of it in any direction which he finds most convenient. The blowing-apparatus is here placed in front under the driving-box, and is worked by a tappet lever. The cylinders, are placed horizontally; and the steam piston is connected with the water pump plunger by one rod working through the two stuffing-boxes, so as to form its own parallel motion. A cross-head, attached to the piston rod, sliding on the frame which supports the two cylinders, works the tappet lever, connecting with the slide, the feed pump, and the blowing apparatus. The feed pump and blowing apparatus have also separate appendages for working them by hand occasionally; and provision has been farther made for regulating the stroke of the former according to the work of the engine.

The steam-cylinder is 7 inches in diameter; the length of the stroke of the piston 16 inches; the number of strokes per minute from 35 to 45; the power barely 6 horse.

Its suction pipe is a common perforated rose, and it may lie in any part of the waterway with the suctions of other fire engines, and take its supply from the same source. It worked with one jet only at the late fire; but is constructed to operate with one or two jets, as occasion may require.

The total weight of the machine, with its complement of fuel and water, is incredibly small; not more than 45 cwt.

Although the engine we have now described is the first of the kind which has been brought into publick operation, it has, we understand, an elder brother, of still greater capabilities. The other engine we allude to, is stated to be of 10 horse power, and capable of throwing *ninety tons of water* per hour, either by one large jet or by four smaller ones. A private trial of it was made lately in the presence of a number of gentlemen connected with the Fire-offices; when the only exception taken to it was expressed in the shape of an apprehension that it would be found, in reality, *too powerful.* We presume that what was meant to be said was, that a ton and a half of water, ejected per minute in a single jet, might as readily knock down some

houses as preserve them from the flames; and there is no doubt such would often be the case. But as this body of water can be as conveniently discharged in four different jets as in one, there can be no serious reason to apprehend any actual inconvenience on this score.—Mechanicks Mag.

Some account of the Structure and Operation of Gurney's Steam Coach.

BY C. H. WILKINSON.

Sir,—I presume, from the great publick attention excited by Mr. Gurney's steam carriage, that a short account of the means by which the whole is propelled, may prove interesting to your readers. I confess that, previous to the opportunity afforded me by the liberality of the patentees at their late visit to Bath, that I contemplated all attempts to substitute mechanical powers for living action as impracticable, unless the resisting medium is in a uniform measured degree, as in rail-roads, &c. It appeared to me, that the constant changes arising from the inequalities of roads, and those ascents and descents which are in the line of communication between Bath and London,could never be counteracted by that perpetual alteration in the force of steam, as such conditions would require. The horse in an instant accommodates his force to the degree of resistance to which he is exposed; the construction of an inanimate machine competent to produce corresponding effects, appeared to me to be attended with insuperable difficulties. Mr. Gurney's Journey to Bath, and his return to London, have induced me to believe that the principal point is attained; and I think the patentees have judiciously concluded to confine its operation to short stages from London, which will afford them opportunities of rendering it more perfect before any extensive line of road is proceeded on. The merit of every machine principally depends on its simplicity. In this respect Mr. Gurney's plan is entitled to every admiration. The power he generates is very little reduced by friction and nearly its whole force is employed, as the propelling agent. The boiler, or generator, as it is termed, consists of about twenty gun barrels, three feet in length communicating at each end with an iron tube, by which arrangement a general communication is effected with every tube, and the barrels are about one inch from each other, and serve as a grating for the fire above, which is fed with coke from the inside of the carriage; a second fire is placed under the barrels, and supplied from the outside; so that this chain of tubes is placed between two fires; these tubes are completely filled with water, so that whatever degree of heat is employed, the water retains its fluid form, and does not assume a vaporifick character before its liberation from the heated barrels; if any additional portion of water be determined into these barrels with a force capable of overcoming the resistance of the valve, then a corresponding portion of water passes into an iron cylinder, about seven or eight inches wide, and two feet long, and immediately flashes into steam; this part of the machine is called the separatory, and answers an important purpose in regulating the force of steam; suppose ten drops of water be converted into steam, at a temperature of 212 degrees, that steam, subsequently exposed to any higher degree of temperature, will not have its powers of pressure increased without an additional dose of water—the separatory supplies the deficiency; so on the contrary, if the fire be not sufficiently active, the steam contains a surplus of water, and which excess is deposited in the separatory, and prevents the working cylinders from being overcharged with that fluid; from the separatory the steam is alternately determined into two cylinders, which are six inches in diameter, with a stroke of 20 inches; the rods of the pistons are attached to cranks on the axle of the hind wheels, these cranks are reverse to each other, and hence by the reciprocating action of the pistons, a complete revolution of the axis takes place; at each end of the axis is a bar of iron the width of the wheel, and secured at each end by bolts to the circumference; by this adjustment the powers of the pistons are advantageously applied to the circumference of the wheel, and the strain prevented which would be the result, if nearer the nave. As the pistons are elevated by the steam, two pumps are worked by rods going through stuffing boxes, and are attached to the piston at the other end; these pumps communicate with the cistern of water, a small portion of which is determined into the generator, to produce the effect already noticed; the stream is afterwards directed into a cooling cylinder, through a worm, part of which is condensed, and returned to the cistern, and the other portion passes immediately through the chimney into the atmosphere.

The average pressure is about eighty pounds to the square inch of the surface of the piston: it is ascertained that double the

pressure does not require the same proportionate increase of fuel; and as economy in this respect is of great importance, the steam in the first instance possesses a power equal to one hundred and sixty pounds, and the communication with the separatory is cut off when the piston has moved through half its range; the expansion of the steam is competent to effect the passage of the pistons through the remaining part of the barrel.

Close by the engineer is a governor, by which he is enabled to regulate the steam, either by increasing its force or diminishing its quantity; and this important part of the operation is managed with great facility.

From coke being employed, and the steam considerably cooled, there is no perceptible smoke, nor clouds of vapour, and the cylinders working about thirty times a minute, the same number of revolutions of the hind wheels take place, supposing the circumference to be fifteen feet, the velocity would be nearly six miles per hour; on level ground, it will move through three times this space, so that there would be ninety strokes per minute; under such circumstances, the steam has a less pressing power, from the water not remaining so long in the generator. The metal which is employed is forged iron; if from any circumstance the pressure of the steam should overcome the resistance of the metal, no explosive effects would be the result, and no dangerous consequences would follow; the iron would rend, and the steam would escape through this small separation, and the action of the machine is necessarily stopped, and it is only by such a cessation that a solution of the continuity in any part of the apparatus is suspended.

One bushel of coke will suffice for two miles, and one gallon of water is consumed each minute; hence every eight or ten miles a fresh supply of water is required, and every twenty or thirty miles, coke.

From a comparative statement of the relative expenses, if we estimate the apparatus and wear equal to four horses, the engineer and stoker as corresponding to the coachman and guard, then the expenses will be reduced to the small compass of travelling. I understand that four horses are estimated at 2s. per mile; while the coke required would not exceed 3d. so that the difference of expenses would be as 3d. to 2s.

Probably a more important result would arise whenever the time shall arrive for the general employment of this mode of traveling; upon a moderate computation, in the British dominions, a million of horses are appropriated to this purpose, as each horse consumes that produce from land equal to the support of seven men, a change of agriculture would be the result, and food for seven millions of inhabitants thus created. From such a reflection, I am induced to conclude with the noble duke at the head of our government, that the advantages are probably incalculable.—(Register of Arts.)

Interesting Experiments before the Royal Society, on Resisting the Agency of Fire.

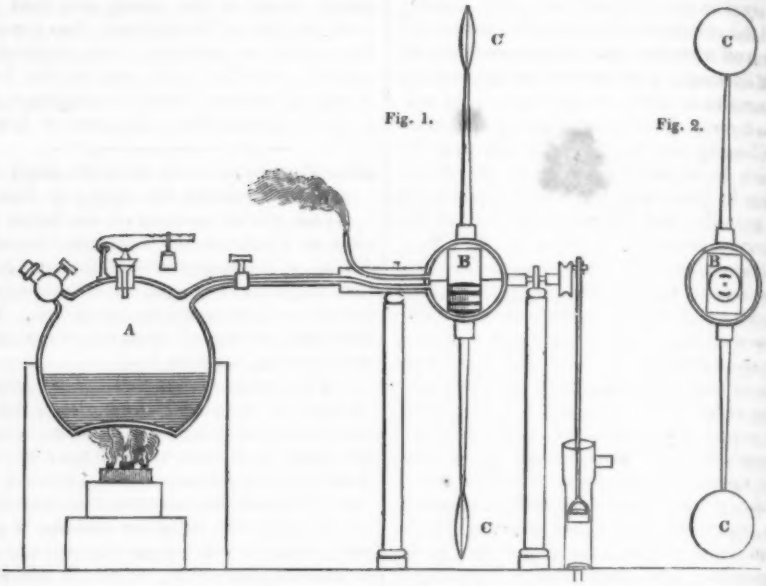
At the weekly meeting of the Royal Society on Thursday, the 21st inst, Chevalier Aldini, of Milan, (nephew of the celebrated Galvani,) exhibited some remarkable experiments on resisting the agency of fire. The following account of them we extract from the "Literary Gazette:"—

"The Chevalier handled red-hot pokers as freely as he would walking sticks; and also supplied asbestos gloves, by which such of the company as chose to make the trial were enabled to do the same. He informed the Society that he had succeeded in constructing an apparatus, or rather clothing, to preserve persons from injury who are exposed to flames; the efficacy of which had been proved at Geneva, where he showed the firemen that a finger, enveloped first in asbestos, then in a double case of wire gauze, might be held in the flame of a spirit-lamp or candle for a long time before inconvenient heat was felt; and then clothing them gradually accustomed them to the fiercest flames.

A fireman having his hand in a double asbestos glove, and guarded in the palm by a piece of asbestos cloth, laid hold of a large piece of red-hot iron, carried it slowly to the distance of 150 feet, then set straw on fire by it, and immediately brought it back to the furnace, the hand not being injured at all in the experiment. Another experiment related to the defence of the head, the eyes, and the lungs. The fireman put only on an asbestos and wire gauze cap, and a cuirass, and held a shield before his breast. A fire of shavings was then lighted in a chafing-dish, and the fireman plunged his head into the middle of the flames, with his face towards the fuel, and in that way went several times round the chafing-dish for a period above a minute in duration. The Chevalier stated that he had an application before his Majesty's Ministers for a space of ground and adequate opportunities to exhibit his experiments."—(London Mechanicks Magazine.)

ROTARY STEAM ENGINE.

The following figure represents the Steam Rotary Engine, spoken of in our last number:



A, (fig. 1,) represents a small steam boiler, heated by a spirit lamp. B, a cylinder, in the lower half of which, a solid piston of lead is shown by the shaded part; the cylinder is surrounded by a globular case, divided into two hemispheres by a bridge, which connects the cylinder with the case; in the axis towards the boiler is two steam passages, one leading from the boiler to the lower part of the case, the other leading from the upper half of the case to the open air; the ends of the cylinder are far enough from the case to allow the steam to pass under the piston to push it up. The shape of the steam passages are shown near the centre of fig. 2. C C, are two balance weights to give momentum to the machine.

Machine for Beating and Hackling Hemp and Flax.

BY M. LORILLARD.

The machine invented by M. Lorillard, for beating and hackling hemp and flax, consists of a balance of a triangular form, having its obtuse angle reversed and furnished with an axis turning on supports, so that the two small sides of the triangle may take alternately, the one a horizontal position, and the other the inclination of 45 degrees. These two sides are furnished beneath with blades, arranged some parallel and others oblique to one another; and these blades take between others fixed on a horizontal strong piece of wood, in the direction of the balance beater, and which is supported by a wooden frame. The workman acting on a lever attached to the extremity of the balance, makes the beater decend alternately, by a vibrating motion; by this means it breaks the hemp and flax, which another workman places on the lower blades. The substance thus beaten twice over, first between the parallel blades, and afterward between the oblique ones, is stript of its woody substance (sa chenevotte.) It is afterward submitted to the action of an apparatus composed of two plates of wood grooved in the same direction, between which it undergoes a friction which deprives it of its resinous gum. It comes out of this apparatus in a state of perfect softness to be afterward passed through combs or hackles of different degrees of fineness, arranged for that purpose on the frame of the machine.—(Bull. de la Soc. d'Encouragement.)

By desire, the following comparison of the relative cost of transportation on the railway and canal of the Lehigh Navigation Company, is laid before our readers. We are not prepared to enter into a detail of the merits of the statement; therefore, we shall leave it with the reader to draw his own inferences.

The economy of transportation on the forty-six miles of canal and river navigation, but chiefly canal, is to ourselves surprizing, though justly imputable to the great width and depth, or very enlarged volume of the Lehigh Canal, which is sixty feet wide and five feet deep. The Chesapeake and Ohio Canal has the same width, with the greater depth of six feet.

The expense of transportation on the Mauch Chunk Railway, is, moreover, without any charge of interest on the capital expended in constructing the road, &c.—The one cent per mile being, as we understand, designed to defray the expense of repairing the railway.

The cost of tolls on the Chesapeake and Ohio Canal cannot exceed, for any commodity, two cents per ton per mile, and, if the transportation (as is most certain) shall cost less than one cent per ton per mile, then three cents per ton per mile will be the highest expense of carriage on this canal; an expense chargeable, it is presumed, on those commodities which can best bear such cost. The cheaper products of lumber, coal, lime, &c. will of course pay less toll than merchandize of great value.—(Ed. Nat. Intell.)

From the Lehigh Pioneer of April 15.

RAIL-ROADS.

We have observed with no ordinary interest, the late accounts of rail-roads, from Liverpool, as well as other parts of this globe of ours. The facilities of communication are evidently greatly improved by rail-roads. The complete success of the 'Novelty' in her experiment for a few hours on the Liverpool rail-road, is in evidence of a great improvement in her boilers, so as to make her a lighter engine than ever was before applied to locomotion. Her saving in fuel is also considerable, only requiring eighty-four pounds coke per hour (her power being about equal to ten horses) it would cost at twenty-five cents a bushel for bituminous coal, say but fifty cents an hour for fuel, and as the cost of food for a horse per day is thirty cents, it would pay for the keeping of twenty horses, allowing her to work twelve hours each day. But the engine goes faster than horses, and would make her fuel about equal to the food of horse power. She is therefore, as cheap a power as horses, provided an increased motion did not materially increase the wear and tear of engine, wagons, and roads.

As the Mauch Chunk Company have been in practical operation with their rail-road nearly three seasons, and have had every facility attending a Company's opertions on a rail-road, and also, in making and repairing wagons and road, every advantage which could be naturally expected has been possessed, there being a foundry on the ground belonging to the Company, and fuel cheap, and water power in abundance for all these operations. All these facilities combined, would, we apprehend, result in producing the minimum average of the cost of using said road. We have therefore sought and procured an average statement of the work done during the said three seasons. It is as follows:

On a transportation of 87,089 tons of coal.

Cost per ton,	Cents.
Wear and tear, and repairing rail-road wagons, ...	8,9434
Oil for do.	2,2908
Break ropes for do.	0,1406
Total expense of wagons, ...	11,3748
Hauling up to summit, hands and team, ...	7,4873
Hauling down from summit, hands and team, ...	17,5113
	36,3734

The distance from the mines to the summit is three fourths of a mile, and ascent forty-six feet; distance from summit to end of road, eight and a quarter miles, and descent seven hundred and sixty-seven feet—making the total distance nine miles: =36 cents, is four cents a ton per mile. The wear and tear of the road is estimated at one cent a ton per mile—thus making the total cost of transportation on this rail-road (exclusive of interest account) FIVE cents a ton per mile.

At this time the same Company are *now* paying twenty-four dollars a trip (and find the boats) from Mauch Chunk to Easton. It is taken at present in rough arks, composed of four or five sections, carrying altogether sixty-five tons of coal, and the cost for the whole distance of forty-six miles is thirty-seven cents a ton.

The ark cost one hundred and thirty-five dollars, and being made rough, will last, say twenty trips only, is a trip $1\frac{1}{4}$—to which add thirty-seven, is $38\frac{1}{3}$=46 miles=8 mills one third a ton per mile—being less than ONE-SIXTH the cost per ton per mile of the transportation on the rail-road.

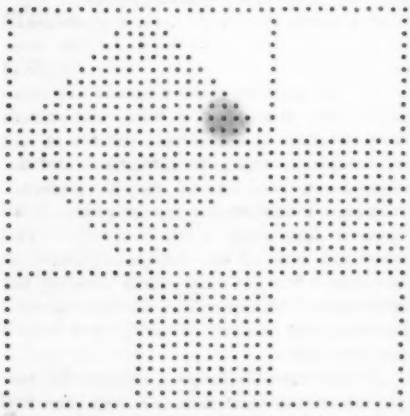
COMMUNICATION.] [FOR THE MAGAZINE.

DIAGRAMICK TYPES.

SIR,—It has often occurred to me that if printing offices were furnished with a sort of type, which I shall designate by the appellation of "Diagramick," the publick would be more frequently favoured with demonstrations in the many mechanical branches than what they now are, owing to the expensiveness of demonstrations cut in wood. In proof of the feasibility of the thing I recommend, I have procured type sufficient for the following diagram. These type are cast on a square *pearl body*, and it is very easy for a compositor to *set up*, with them, the plan of a building, a circle, square, &c. or even the form of an animal. I hope, sir, the hint may be improved upon by some of our enterprizing printers, or founders.

The accompanying diagram will, I think, show that in any right angled triangle, the square which is described upon the side subtending the right angle is equal to the squares described upon the sides which contain the right angle.

DEMONSTRATION.



Construct a figure containing nine squares, draw a diagonal line across the centre square, which will be the hypotheneuse, or side subtending the right angle; on which describe a square by drawing diagonals across three other squares, and the diagram will be complete. Now, since a diagonal line, drawn across a square, divides it into two equal parts, the square formed by four such diagonals, will contain four half squares or two whole ones, and are equal to the two squares described upon the other two sides.

I should like to see the "Diagramick Types" brought into use, as many demonstrations, sufficiently intelligible, may be made with them. T. C.

RUMFORD PREMIUM.

We understand that this subject is in the hands of a committee of the society named in our last number.

An instance somewhat similar in its character with that of the Rumford premium, existed in the fact of an individual in London, styling himself "a lover of useful knowledge," having offered as a donation to the American Philosophical Society, held at Philadelphia for promoting useful knowledge, the sum of two hundred guineas, the interest of which, to be annually disposed of in premiums for discoveries relating to navigation, astronomy, or natural philosophy. Dr. Franklin was afterwards, say in 1786, president of the society. The Rev. Dr. John Ewing, Rev. Dr. Wm. White and Samuel Vaughan, Esq. vice-presidents. The present state of this fund would, undoubtedly, be interesting; and, very possibly the editors of the Journal of the Franklin Institute may be able to favour the publick with it. The society accepted the premium, and proceeded to publish the conditions, &c. upon which the premiums would be awarded.

COMMUNICATION.] [FOR THE MAGAZINE.

Some account of the Fund given by Dr. Franklin, to the Inhabitants of Boston.

Dr. Franklin, in his will, gave one thousand pounds, sterling, to the inhabitants of the town of Boston, "to be managed under the direction of the select men, united with the ministers of the oldest Episcopalian, Congregational and Presbyterian churches in that town, who are to let out the same upon interest, at five per cent. per annum, to such young married artificers under the age of twenty-five years, as have served an apprenticeship in the said town, and faithfully fulfilled the duties required in their indentures, so as to obtain a good moral character from at least two respectable citizens, who are willing to become their sureties in a bond with the applicants, for the repayment of the monies so lent,

with interest, according to the terms hereinafter prescribed; all which bonds are to be taken for Spanish milled dollars, or the value thereof, in current gold coin; and the managers shall keep a bound book or books, wherein shall be entered the names of those who shall apply for and receive the benefit of this institution, and of their sureties, together with the sums lent, the dates and other necessary and proper records respecting the business and concerns of this institution; and as these loans are intended to assist young married artificers in setting up their business, they are to be proportioned by the discretion of the managers, so as not to exceed sixty pounds, sterling, to one person, nor to be less than fifteen pounds; and if the number of appliers, so entitled, should be so large as that the sum will not suffice to afford to each as much as might otherwise not be improper, the proportion to each shall be diminished, so as to afford every one, some assistance. These aids may therefore be small at first; but as the capital increases by accumulation of interest, they will be more ample, and in order to serve as many as possible in their turn, as well as to make repayment of the principal borrowed, more easy, each borrower shall be obliged to pay with the yearly interest, one tenth part of the principal, which sums of principal and interest so paid in, shall again be let out to such borrowers; and as it is presumed that there will always be found in Boston, virtuous and benevolent citizens willing to bestow a part of their time in doing good to the rising generation, by superintending and managing this institution gratis, it is hoped that no part of the money will at any time lie dead, or be diverted to other purposes, but be continually augmenting by the interest; in which case, there may in time, be more than the occasions in Boston shall require, and then some may be spared to the neighbouring, or other towns in the state of Massachusetts, who may desire to have it; such towns engaging to pay punctually the interest and the proportions of the principal annually, to the inhabitants of the town of Boston. If this plan is executed and succeeds, as projected, without interruption for one hundred years, the sum will then be one hundred and thirty-one thousand pounds, of which I would have the managers of the donation to the town of Boston, then lay out, at their discretion, one hundred thousand pounds in publick works, which may be judged of most general utility to the inhabitants; such as fortifications, bridges, aqueducts, publick buildings, baths, pavements, or whatever may make living in the town more convenient to its people, and render it more agreeable to strangers resorting thither for health or a temporary residence. The remaining thirty-one thousand pounds I would have continued to be let out on interest, in the manner above directed for another hundred years, as I hope it will have been found that the institution has had a good effect on the conduct of youth, and been of service to many worthy characters and useful citizens. At the end of this second term, if no unfortunate accident has prevented the operation, the sum will be four million and sixty-one thousand pounds, sterling, of which I leave one million sixty-one thousand pounds to the disposition of the inhabitants of the town of Boston, and three million to the disposition of the government of the state, not presuming to carry my views any farther."

This legacy was received by the trustees in the year 1791, and the first loan made on the third day of May of that year. The whole number of loans up to the present time has been two hundred and forty-eight, and the sums usually loaned, have been of $100 or $200, upon the written application of the borrower to the trustees, describing his qualifications according to the terms prescribed in Dr. Franklin's will, and proposing his sureties. Since the first day of January, 1820, the whole number of loans has been thirty-one, and since the first of January, 1825, the whole number of loans has been twelve only. In consequence of the decreased number of applications there has been a great accumulation of the fund, which could not be invested according to Dr. Franklin's directions, and for the last ten years, the trustees have, from time to time, directed investments to be made in bank notes and in the city debt, and latterly, in the office of the Massachusetts Hospital Life Insurance Company, by which the interest has been saved.

It will appear, by the following statement, that the demands for loans from the fund, have been gradually decreasing:

From April 1791 to April 1801, 90 loans were made, being at the rate of 9 loans annually; from April 1801 to April 1811, 71 loans, being 7½ annually; from April 1811 to April 1821, 60 loans, being 6 annually; from April 1821 to April 1826, 21 loans,

being $4\frac{1}{5}$ annually; from April 1826 to Oct. 1829, 6 loans, or less than 2 annually.

Of sixty loans, made during a period of about ten years, thirty-eight were paid (in whole or in part) by the sureties, and connecting this fact with the diminished number of applications for loans, renders it certain that the benevolent intentions of Dr. Franklin have not been realized to their full extent; nor has the increase of the fund, founded upon a never ceasing accumulation of interest, been by any means realized. Losses have happened, occasionally, by the insolvency of the principal and sureties, particularly, during the embargo and war, and until the trustees directed the investment of monies on hand, they of course produced no interest.

The present value of the fund is as follows:

Estimated amount due on bonds, and believed to be good, ...		$3,675,24
Deposited in the office of the Mass. Hos. Life Insurance Company,	11,450,00	
Estimated accumulation of interest to Oct. 1,	1,553,63	
		13,003,63
Balance of the treasurer's account settled,		1,011,77
Recd. by the treasurer, since, ...		30,00
		$17,720,64

Giving an increase on the original donation, at simple interest, of about eight and one quarter per cent. per annum.

W. Minot, Treasurer.

Boston, May, 1830.

We met with an article in a Limerick paper sometime since on the subject of removing ice from the side walks by the operation of salt, and set ourselves about the experiment, which we found had the desired effect where the ice was thin; but we considered our own Yankee mode of removing the ice as much the easiest and most economical. We now have before us an article on this subject which we find in the London Magazine for January. The writer's experience agrees with our own, as made in Boston about the time he made his communication.

On the Effect of Salt in Dissolving Ice.

"Sir,—The common table-salt having lately been recommended to produce the easy removal of snow and ice from the pavements, a few remarks on this property of the muriate of soda may not be altogether unacceptable to numerous readers of your valuable Journal.

Many have, no doubt, been too sceptical either to try the experiment, or to treat it as a chemical fact, depending upon that hygrometrick quality which this and other salts possess when the base is an alkali. Those salts which have an affinity for moisture, so powerful as even to liquefy in an atmosphere not to our feelings sensibly damp, and the solutions of which do not so readily part with their calorick, as to allow the aqueous particles to freeze in a climate like ours, at the severest seasons must, when strewed in a dry crystalline state upon ice, exercise a very energetick influence upon the corpuscles of the congealed water, in consequence of the superiour affinity we have spoken of; and this action will be more rapid and more effectual on ice than on snow, owing to the porosity of the latter preventing the atoms of the two bodies from coming into close contact. A portion of salt may lie on a piece of trodden snow for hours before traces of either are lost; but it is quite otherwise when ice is substituted; then the salt has a dense mass to act upon, and in a short space of time the surface is covered with a strong brine. When sulphurick acid is exposed to intense cold, it is not the acid but the water that freezes; and the same principle holds good with the sea-water in the northern regions, or wherever it is found frozen over, for the ice when dissolved produces fresh water suitable for ordinary purposes on board ship, and is even made use of in the culinary operations.

Marine salt as it dissolves the surface of the ice is attended with a slight crackling, occasioned by the contraction of the ice as it enters into solution. If the experiment be made on a thin coating of ice or frozen snow on a flagged foot-walk, liquefaction soon takes place wherever the salt has fallen, but spreads slowly, and does not loosen the ice, as some may be led to imagine, so as that it might be removed in broken lumps; it is the dissolved parts only which can be swept away, and to carry this artificial thaw to any extent requires a large quantity of salt.

I am, Sir,
Yours truly,
H. D."

POOR-HOUSE GARDENS.

An excellent suggestion appeared lately in the Gardener's Magazine; that of having extensive gardens annexed (it is not meant locally) to parish poor-houses. It is very justly stated that there is no description of labour, in which all manner of persons, young and old, male and female, could so universally be of use, and that with the least irksomeness of all kinds of toils, as in the cultivation of a garden. 'God Almighty,' says one of the wisest men that ever adorned humanity, 'first planted a garden; and, indeed, it is the purest of human pleasures.' It is, moreover, peculiarly favoured in this, that while it is the pleasantest of all descriptions of labour, it is for the gratification of simple events, the most profitable also; and therefore, the suggestion of the Gardener's Magazine, is a hint which we think may be improved on with much advantage in the highest quarters, to which the consideration of a provision for our poor extends.—(Blackwood's Magazine.)

As this subject seems to have elicited the attention of the respectable conductors of the London Magazine, they will doubtless be much gratified to hear that there are in Massachusetts many establishments of the character of which they speak. The largest, we believe, are in Salem, Marblehead and Boston. Within the precincts of this city, (called South Boston,) is the "Poor House Establishment," as it would, in England and many places in our own country, be called, but in our own state known as "*House of Industry*," consisting of two extensive stone buildings, each two hundred and twenty feet in length, forty feet wide and four stories high, with something over fifty acres of land attached to them, laid out in orcharding, grass, and one of the most beautiful and productive gardens any where in the vicinity of the city. The whole establishment is under the care of a board of directors, annually elected from our most respectable citizens, and who are deeply devoted to the interests of their appointment, for which, like all our other principal officers, they receive no pecuniary compensation; conducting the establishment, containing this winter not far from five hundred and fifty souls, men, women and children, (being all the poor of a population of rising 60 thousand,) at an expense which, for the economy, is probably unexampled in any other part of the world similarly situated. We feel proud by thus having been, in many towns in this commonwealth, from ten to fifteen years in anticipation of what is so earnestly recommended in the older countries on the other side of the water.

TO CLEAN PICTURES.

Water is the first material, and of the most general use in cleaning pictures.—This will remove many kinds of glutinous bodies and foulnesses; such as sugar, honey, glue, and many others; and it will also take off any varnish of gum arabick, glair of eggs, or isinglass, and is therefore the greatest instrument in this work. It may be used without any caution with respect to the colours, as it will not in the least affect the oil which holds them together.

Olive oil, or butter, though not generally applied to this purpose, will remove many of those spots which resist even soap; as they will dissolve or corrode pitch, resin, and similar bodies, they may be used very freely, having no bad effect on the painting. Pearl ashes, melted in water, make a proper dissolvant for most kinds of matters which foul paintings, but this must be used with great caution.—Spirit of wine, as it will dissolve all the gums, and gum resins, (except gum arabick) is very necessary for taking off picture varnishes composed of such substances; but it corrodes the oil of paintings, and softens them in such a manner as to render all rubbing dangerous while they are under its influence. Oil of turpentine will likewise dissolve some of the gums used for varnish; but spirits of wine will generally answer the purpose much better. When paintings appear to have been varnished with those substances that will not dissolve in water, they are very easily and safely removed by the following method, viz.

Place your picture, or painting, in a horizontal position, and moisten, or rather flood the surface of it with strong rectified spirits of wine; but all rubbing, beyond what is absolutely necessary, must be avoided. Keep the painting moist, by adding fresh spirit, if requisite, for some minutes, then flood the surface copiously with cold water, with which the spirit, and such part of the

varnish as it has dissolved, may be washed off; but in this state of it, all friction must be avoided.—When the painting is dry, the operation may be repeated, until the whole varnish is removed.—(Mechanicks Register.)

GINGER BEER POWDERS

May be prepared in the following manner:—take two drachms of fine loaf sugar, eight grains of ginger, and 26 grains of carbonate of potash (all in fine powder;) mix them intimately in a Wedgewood's ware mortar. Take also 27 grains of citrick or tartarick acid, (the first is the pleasantest, but the last the cheapest.) The acid is to be kept separate from the mixture. The beer is prepared from the powders thus:—Take two tumbler glasses, each half filled with water; stir up the compound powder in one of them, and the acid powder in the other; then mix the two liquors. An effervescence takes place—the beer is prepared, and may be drank off. It must be drank off directly, or it will become flat.

OIL FOR WATCHMAKERS.

Olive oil can be purified in the following manner;—the method is simple, but certain.

"Put the oil into a white glass bottle, hang it up in a window exposed to the sun; in two or three months it will be as clear and white as water, all the impurities being thrown to the bottom."

NOTICE OF CHROME ORANGE.

In Brande's Quarterly Journal, from October to December, 1829, Mr. Graham remarks, "It is singular, that although no other colour has been so much run upon for a couple of years in cotton yarn, no account of the mode of raising this beautiful tint, so far as I can learn, has hitherto been published; yet this process is universally known and followed by dyers. The first object is, to procure upon the yarns a good body of chrome yellow, of the ordinary and familiar tint of chromate of lead. For this purpose, the goods are well charged with protoxide of lead, which is done by dipping them in a solution of acetate of lead, and then decomposing the salt by lime water, of which the lime takes the acetick acid, and leaves the oxide of lead in the cloth. Every trace of lime must then be got rid of by washing.

It is necessary to have nothing but oxide of lead on the cloth; for, with acetate or nitrate of lead, as the mordant, the colour will be uneven. The goods are then passed through a bath of bi-chromate of potassa, which instantly strikes the chrome yellow with the oxide of lead.

The orange is raised by throwing the goods so prepared into lime water at, or near, a boiling heat. Lime, at that temperature appears to be capable of partially decomposing the chromate of lead, taking half the chromick acid from a greater or less portion of that salt, and reducing it to the state of di-chromate of lead. The di-chromate of lead is itself of a full red colour."

THE SECRET OF THE COMPOSITION OF THE SCHWEINFURT BLUE.

"A portion of a very fine blue pigment was placed in the hands of M. Braconnot, by M. Noel, for examination. It was the produce of a manufacture at Schweinfurt, where the preparation was kept secret. M. Braconnot readily ascertained it to be a tripple compound of arsenious acid, hydrated deutoxide of copper, and acetick acid; so that it approximates to the green of Scheele. After various trials to form it, the following process was found to be the best. Six parts of sulphate of copper were dissolved in a small quantity of water; also, six parts of white arsenick, with eight parts of potash of commerce, were boiled in water, until no further quantity of carbonick acid was disengaged. This hot solution was gradually mixed with the first, continually agitating until effervescence ceased; an abundant dull yellowish green precipitate was formed. About three parts of acetick acid were then added, or such a quantity, that a slight excess was sensible to the smell; gradually the precipitate diminished in volume, and in some hours a slightly crystalline powder was deposited at the bottom of an entirely colourless solution. The fluid was poured off as soon as possible; and the powder, washed with plenty of boiling water to remove the last portions of arsenick, was then of a brilliant colour.

Care must be taken not to add to the cupreous solution an excess of arseniate of potash, as it causes waste of the acetick acid afterwards added, as the latter must be in excess. In repeating the process in the large way, an arsenite of potash, prepared with eight parts of oxide of arsenick, instead of six, was used, and the result was very successful. M. Braconnot thinks that probably a slight variation of the proportions he has given may be found advantageous; but in the mean time he considers it right to give the best process he is able for the preparation of a colour so beautiful, and which may be very valuable in the arts."

VOLATILE OIL.

"At a time when locomotive engines are likely soon to be found traversing all the populous districts of the country, it becomes highly desirable that these moving furnaces should be so heated as not to annoy the inhabitants with a never-ending stream of smoke, and we have the pleasure to find that this *desideratum* can now be effectually attained. In the manufacture of resin and

oil gas a large quantity of volatile oil is collected. This combustible liquid is now used instead of coal at the oil gas-works in Leeds to heat a bench of four retorts, which generate 600 feet of gas per hour; and the heat is kept up during the day without the slightest variation, with two gallons of the volatile oil per hour, giving out neither the least smoke nor smell. The advantages of this discovery for the use of locomotive engines it is scarcely possible to appreciate; and it is amongst the least of them, that two gallons of the volatile oil, weighing only 16lbs. will produce as much heat as 112lbs. of coke, thereby diminishing the weight of fuel to be carried seven pounds in every eight.—(Leeds Mercury.)

BOSTON MECHANICKS INSTITUTION.

THIRD ANNUAL REPORT.

In conformity with the requisition of the constitution, the board of managers respectfully offer to the members of the Boston Mechanicks Institution, their third annual report of the doings of the board, and of the state of the institution.

Immediately upon the organization of the board they proceeded, upon the nomination of the institution, to the choice of the Hon. Nathaniel Bowditch, our late president, as its first honorary member.

In making preparation for the lectures, the board have endeavoured to pursue the course so successfully begun by their predecessors, by obtaining such as should embrace a sufficient variety of subjects to admit persons of different taste and pursuits, and be sufficiently minute on each subject to make a permanent impression.

They consider themselves as peculiarly favoured in the manner in which they were enabled to have the course opened. The introductory address was delivered by the Hon. Judge Story, who consented, notwithstanding extraordinary calls on his time, to testify, in this manner, the interest he feels in the objects of our institution, and who gave an exciting view of the value of instruction to mechanicks, and of the wide field opening before them if they rightly use it.

Six lectures were given by Prof. Farrar; one on the "magnitude and figure of the earth," and five on the "constitution and properties of the atmosphere."

Three lectures were given by Dr. Ware, on the "mechanicks of the human body." It was thought fully within the scope of our design to examine, with some degree of care, this most perfect of structures, exemplifying as it does in a thousand ways, the most wise and beautiful mechanical contrivance.

Two lectures were given by the Hon. William Sullivan, upon contracts; the first, upon the "implied or express contracts, which lie at the foundation of natural, international and municipal law;" the second, upon "contracts between individuals."

Three lectures were given by W. Colburn, Esq. upon hydraulicks; the first two upon "the motion of water in pipes, and the spouting of water from variously shaped orifices;" the third, upon "water wheels."

Five lectures were given by Prof. Webster upon "the chemical properties of the constituents of the atmosphere."

The course was concluded, on the 31st of March, with a lecture from Dr. Warren, upon "the general structure and functions of the human body, and the great importance, to the community, that a thorough knowledge of them should be possessed by the physician."

It will thus be seen, that the instruction has been, in a great measure confined to a few objects of primary importance; the human body, the atmosphere by which it and all things on which it acts are enveloped, and water one of the principal mechanical agents. By this arrangement, the board conceive they have done what they could to obviate the most valid objection which is made to this mode of communicating knowledge, that it usually presents so great a variety of objects that only a transient impression is left on the mind.

The number of members admitted within the year is one hundred and twenty-six, to whom, and to the previous members, five hundred and nine tickets have been issued; one hundred and seventy-three minor's tickets have also been issued, so that the whole number admitted to the lectures this season, is six hundred and eighty-two. It was found that the minors were so numerous that they could not be accommodated in the hall at the same time with the members; and it became accordingly necessary to have the lectures repeated, to them, in a separate class. The necessity of this arrangement is to be regretted, as it makes an uncompensated charge upon the funds, of a large sum which it would have been desirable to devote to the extension of the cabinet of apparatus.

On comparing the number of tickets, issued during the last year, with those issued in the preceding, we find a diminu-

tion, which, taken by itself, would seem to indicate that less interest is now felt in the objects of our institution. We believe the truth to be quite the reverse. The great success of the system adopted by this institution, has led to the formation of other societies, in which, valuable and popular lectures have been delivered, which have naturally attracted a portion of the publick attention. We ought to feel any thing but discouragement at the successful imitation of our example. As friends to the cause of publick instruction, it must afford the members the greatest satisfaction to know that a greater number of lectures has been this year delivered, and usually to very full audiences, than has ever before been given, within the same space of time, in this city. The cause, therefore, in which this institution led the way, has gone on in uninterrupted success, and has never before been so prosperous as it is at the present hour.

And while we rejoice in the favourable appearance of things at present, we trust we have claims, in the nature and objects of our institution, to the continuance of the favour with which it has been regarded. The two prominent objects, towards the accomplishment of which the attention of the successive boards has been directed, are such as merit, and, we doubt not, will continue to receive the approbation and support of the friends of publick improvement. These are the offering of lectures on *such subjects as cannot be understood without lectures*, and the collection of the apparatus essential to their illustration.

On some of the subjects on which popular lectures are sometimes given, an equally good effect would be produced by cheap publications; but many of the most important inventions, in the arts; the developement of scientifick principles and their application to machinery; the action of machines themselves, and, in short, every thing in natural philosophy, of which the proof consists in an experiment, must be addressed to the eye in experimental lectures, in order to reach the mind with the conviction of truth.

Hence, also, the importance of collecting philosophical apparatus and models of machines. On their completeness and adaptation to their purpose, the success of every course of experimental lectures must, in a great measure, depend.

We may well be satisfied with the beginning which has been made, in the excellent and beautiful instruments already in our cabinet. Of their acknowledged value, a proof is presented in the fact that application has been made to the board, for the loan of some of them, to be employed in lectures to the students of Harvard University, with the offer of an equivalent in the use of the philosophical apparatus belonging to that institution. For this purpose an arrangement has been entered into on terms of reciprocal advantage.

The permanent value to the publick of such a cabinet as it is proposed to form, constitutes, we think, a strong claim upon the patronage of intelligent and publick spirited gentlemen, even when they have no leisure or inclination to attend the lectures delivered before the institution. That the managers may be enabled to continue and complete a collection, which, we believe, has been begun in no other society in this city, the institution must rely on the continued favour and munificence of our fellow citizens.

The report of the treasurer, herewith submitted, shows that there was in his hands, at the beginning of the year, the sum of $223,36

There has been received in donations, ...	128	
From admission fees, annual assessments and minor's tickets, ...	1,235	
Making the rects. of the year	1,363	
Which, together with what was in the treasurer's hands amts. to the sum of		1,586,36
Expenses of the institution during the year for rent, lectures and other necessary charges, have been		1,225,38
Leaving now in the hands of the treasurer, ...		360,98
There remain several outstanding accounts which may be estimated at . . .		320,00
Which will leave in the hands of the treasurer,		40,98

All which is respectfully submitted.

D. Treadwell, Prest. of the Inst.

Geo. B. Emerson, Corres. Sec'y.

Boston, April 26, 1830.

The following is a list of officers of the "Boston

Mechanicks Institution," chosen at their annual meeting on Monday evening, April 26, 1830:

DANIEL TREADWELL, President.
DAVID MOODY, CHARLES WELLS, ALEXANDER PARRIS, } Vice-Presidents.
F. C. WHISTON, Recording Sec'y.
JOHN WARE, Corresponding Sec'y.
STEPHEN FAIRBANKS, Treasurer.

Directors, Ebenezer Bailey, Alpheus Carey, Timothy Claxton, John Cotton, George Darracott, Phinehas Dow, George B. Emerson, Isaac Harris, Wm. Hayden, Jr. Frederick Lane, Benjamin Loring, James McAllister, C. C. Nichols, John Pierpont, John Rayner, J. Gorham Rogers.

SHIPS FOUNDERING AT SEA.

In our last number of the Magazine, we published an article of Dr. Franklin's on this subject. We have before us a short article from an English print, which we offer to our readers. From the great number of vessels which are lost every year, through this means, every thing which can be made publick on so interesting a subject, should be.

"SHIPS.—Mr. Watson's plan for preventing ships foundering at sea, consists in introducing air tight copper tubes in the spaces between the beams of the decks; also between the timbers, or ribs, the shelf-pieces and the planking, and in all other places between the decks which may be thus occupied without inconvenience. These tubes are intended to contain a bulk or quantity of atmospherick air, equal to counterbalance that extra portion of the weight, or specifick gravity of the ship and her contents, which otherwise, in case of leaks, and the ship filling with water, would cause her to sink. There can be no doubt of the efficacy of the principle. With the view of affording a practical elucidation of his plan, Mr. Watson constructed a model, in due proportion to the dimensions and actual weight of an eighty-gun ship when equipped for a four months' voyage. This model having a leak in her bottom, when placed in water without the tubes sank immediately; but with the tubes affixed to the main, the middle, and the lower decks, she floated with a power of buoyancy so great, that, on being forcibly pressed under water, she again rose to the same point of elevation as before, viz: with the main deck above the surface. Mr. Watson entered into a statement of the ships, both of war and merchantmen, which had been wrecked, burnt, or foundered, between the years 1793 and 1826; from which it appeared, that during the above period no fewer than 373 of the former class of vessels, and 557 of the latter, had been destroyed."

EFFECTS OF REFRACTION.

Captain Scoresby, on his return from his first landing on the east coast of Greenland, at Cape Lister, in lat. 70° 30′ N. gave the following interesting account in his journal of an extraordinary instance of the optical phenomena produced by refraction. "It was about 11 P. M., the night was beautifully fine, and the air quite mild. The atmosphere, in consequence of the warmth, being in a highly refractive state, a great many curious appearances were presented by the land and icebergs. The most extraordinary effect of this state of the atmosphere, however, was the distinct inverted image of a ship in the clear sky, over the middle of the large bay or inlet before mentioned —the ship itself being entirely beyond the horizon. Appearances of this kind I have before noticed, but the peculiarities of this were—the perfection of the image, and the great distance of the vessel that it represented. It was so extremely well defined, that when examined with a telescope, made by Dolland, I could distinguish every sail, the general 'rig of the ship,' and its particular character; insomuch that I confidently pronounced it to be my father's ship, the Fame, which it afterwards proved to be—though, on comparing notes with my father, I found that our relative position, at the time, gave the distance from one to another nearly thirty miles, being about seventeen miles beyond the horizon, and some leagues beyond the limit of direct vision. I was so struck by the peculiarity of the circumstance, that I mentioned it to the officer of the watch, stating my full conviction that the Fame was then cruising in the neighbouring inlet."

COMMUNICATIONS.] [FOR THE JOURNAL

MATHEMATICAL QUESTION.

Required, an easy geometrical rule, whereby a cooper may cut a large bottom into four equal bottoms so as to lose the least stuff possible.

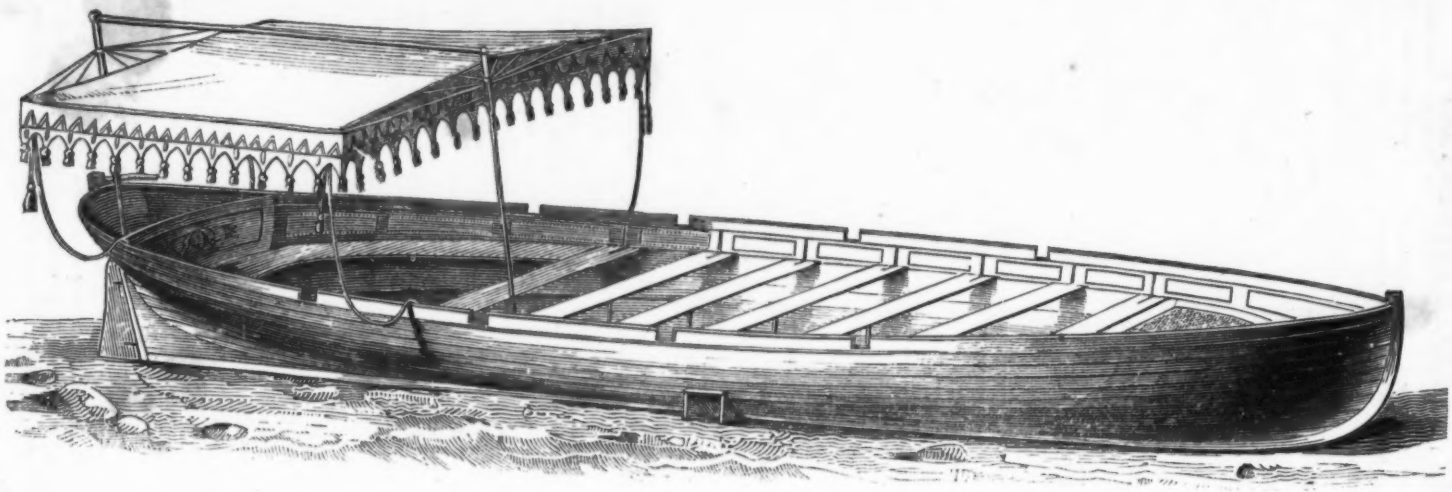
PIPES FOR BEER.

SIR,—In your third number you wish for hints on the subject of inventions and improvements in the mechanick arts. I think that the person who shall invent a pipe that will be nearly as cheap as lead pipe, and as wholesome as tin, or pewter pipe, would deserve to be handsomely rewarded. A wholesome beverage, loses much of its good effects by being kept in improper vessels.

TEMPERANCE.

IMPERIAL GALLON.

MR. EDITOR,—I should be glad if any of your readers would inform me, how many cubick inches, the English Imperial Gallon contains? I believe the size of it is between the wine and ale gallon. METER.



The above is a correct representation of that beautiful barge referred to in our last number, for the particulars of which see p. 93 of the Magazine for April.

COMMUNICATION.] [FOR THE MAGAZINE.

SIR,—You would greatly oblige a subscriber, (and no doubt the mechanicks of Boston,) if you would insert in your Magazine, a useful method of computing the power of a High Pressure Steam Engine, by Mr. Charles Potts, and which was published in the Journal of the Franklin Institute, No. 2, Vol. 5. Although a great part, if not all of it, may be found in Tredgold, on the Steam Engine, yet, as it is here condensed into a small space it is of great value.

A SUBSCRIBER.

[We thank "A Subscriber" for the hint he has given us, and regret that we are not able to give the whole of the article in the present number, owing to the lateness at which it was received. It will be concluded in the June number.]

"From the dynamical relation, that the force or power of an engine is equivalent to the momentum, or quantity of motion which it is capable of producing, we shall have, putting F, for the *efficient force* of the steam on the piston of the engine, A equal to the area of the piston, V the velocity when the performance of the engine is the greatest, and P the power of the engine.—$P = A \times F \times V$. Or, as it is usual to compare the power of the engine with that of horse power, let S be the standard of comparison, then

$$P = \frac{A \times F \times V}{S}$$

This rule which answers for computing the power, either of the high or low pressure steam engine, may be otherwise expressed in words, thus:

Multiply the area of the piston by the efficient force of the steam acting thereon, this product being again multiplied by the number of feet the piston travels when the effect of the engine is the greatest, and divided by the standard of horse power, the quotient will be the relative power of the engine.

To illustrate the above rule, let us take for an example the following case: A low pressure engine, having a cylinder 24 inches diameter, makes 20 strokes per minute, each stroke being 5 feet long; the efficient force of the steam being equivalent to a pressure of 10 lbs. per square inch. Here $A = 452.4$ square inches, $F = 10$ and $A \times F = 4524$ lbs. the whole pressure on the piston, or the weight which the engine raises with a certain velocity. To find the velocity we say the engine performs 20 *double* strokes, each 5 feet long, in a minute; hence $V = 20 \times 2 \times 5 = 200$ feet, the rate at which the piston travels per minute. If we assume $S = 32.000$ lbs. according to Bolton and Watt, then

$$P = \frac{A \times F \times V}{S} = \frac{4524 \times 200}{32.000} = 28\tfrac{1}{4}$$

horses, the power of the engine, the engine being supposed to work only 8 hours in the 24.

Had F, in the preceding example, been taken equal to 100 lbs. to the square inch, answering to the case of a high pressure engine, we should have deduced $P = 282\frac{1}{2}$ horses, the velocity of the engine being as before.

In the preceding rule, however, we have supposed V the velocity with which the piston travels, to be such that the performance of the engine will be the greatest, or the power P, thus obtained, to be the *maximum* power of the engine, answering to the given pressure. Whether the powers assigned in the preceding examples are the maximum powers of the engine, answering to the respective pressures of 10 lbs. and 100 lbs. per square inch, will be shown in the subsequent part of this inquiry.

It is usual with engine makers, for the apportionment of *low pressure* engines, to calculate the velocity of the piston as answering to the maximum performance of the engine at 200 feet per minute, the same that is ordinarily assigned for the speed of a *horse* when tracking to the best advantage.

In rating the *high pressure* steam engine, the efficient force is commonly estimated at 100 lbs. per square inch, or the pressure on the safety valve at 150 lbs. per square inch, one-third being subducted for the loss by friction, &c. With this pressure the maximum velocity is calculated at about 320 feet per minute.

The question under consideration, however, being general, or *not limited to any particular* pressure, we shall, therefore, inquire the value of V, the proper velocity with which the engine should move, whatever may be the pressure, as also F, *the efficient force or load* the engine should be charged with to produce it.

It is known that the velocity with which a fluid rushes into a *vacuum*, is equal to that which a heavy body would acquire in falling through a height equal to the *head of pressure*.

To find the velocity, therefore, with which steam, say at the temperature of 212° would rush into a vacuum, we have, by experiments, the weight of a cubick foot of steam at this temperature equal to 253 grains. Hence, as 480×1000 grains : 1728 cubick inches : : 253 grains : .9107 cubick inches = to the bulk of water in a cubick foot of steam at the temperature of 212°, which is very near what it in common is assumed to be, viz: *one cubick inch*. Again, as 1728 : .9107 : : 1000 the specifick gravity of water : 5.27 the specifick gravity of steam.

The force of steam at the temperature we have assumed being known to equal that of the common atmospherick pressure, or 30 inches of the barometer, taking, therefore, 13600 as the specifick gravity of quicksilver, by the following analogy, we shall have 5.27 : 13600 : : 30 inches : 77419 inches, or 6451½ feet, the *head of pressure* corresponding to the steam, when its force is supposed just equal to that of the common atmosphere.

The velocity that would be acquired by a heavy body in falling through this height, is readily found from the dynamical relation $V = 2\sqrt{gs}$, where V denotes the velocity, s the space fallen through, and $g = 16$ 1-12 feet the force of gravity. Substituting 6451½ for s in this expression, we shall find $V = 2\sqrt{gs} = 644$ feet per second, the *velocity with which the steam would rush into a vacuum.*

Now since the density of steam must be as the pressure, let D denote the density (or pressure) of steam at any temperature, and H the corresponding head of pressure.

Assume R, equal to the density of any medium into which we shall now suppose the steam to rush. Then it is obvious that the steam having the density D, when opposed by the medium, the density of which is R, will have the same velocity as though it rushed into a vacuum, with a pressure or density equal to D — R.

To find the head of pressure corresponding to this density, we have by analogy

$$D : D - R :: H : H\left(\frac{D-R}{D}\right) = \text{to}$$

the head of pressure, or the height a body must fall to acquire a velocity equal to that with which the steam would rush into the medium.

The spaces described by falling bodies, being proportional to the squares of the velocities. If, now, v be put to represent the velocity with which steam (when its pressure is equal to that of the common atmosphere) rushes into a vacuum, or 644 feet per second, and h, its corresponding head of pressure, or 6451½ feet. Then V being put for the velocity with which steam, having the density equal D — R, would rush into a vacuum, we shall have by the above proportion

$h : H\left(\frac{D-R}{D}\right) :: v^2 : V^2$. From whence it follows that $V = v\sqrt{\frac{H}{h}\left(\frac{D-R}{D}\right)}$ which is also equal to the velocity in feet per second, with which steam, having the density or pressure D, would rush into a medium, the density (or resistance) of which we assumed equal R.

In order to apply the above expression, for finding the velocity with which steam of any density, passes into the cylinder of a steam engine, or the velocity with which the piston is urged, it is obvious, supposing the density of the steam, and, consequently, the motion of the piston, to be uniform during the working of the engine, that R must be taken equal to the *total resistance* which the preponderating pressure of the steam has to overcome, that is, R may represent the load, friction, &c. of the engine.

The foregoing expression for the velocity relates to that of steam passing through a simple aperture; the velocity with which the piston moves, therefore, will be to the velocity with which the steam rushes through the steam pipe, or *openings*, as the area of the opening is to the area of the piston. Put O = to the area of the opening, and A = to the area of the piston, then the velocity of the piston will be expressed by $\frac{O}{A} \times v\sqrt{\frac{H}{h}\left(\frac{D-R}{D}\right)}$ it is obvious that the greatest velocity with which the piston may move will be when R = o and the velocity in this case would become

$$\frac{O}{A} \times v\sqrt{\frac{H}{h}}$$

Now it is established in dynamicks, that when the velocity with which any engine works is *one-third* of the *greatest velocity* with which it is capable of working, then will the work done be *a maximum*, or the greatest possible.

Hence it follows that the velocity with which the piston should move in order that the performance of the engine may be the greatest, or the value of V answering in the formula for the power of an engine is

$$V = \frac{1}{3} \times \frac{O}{A} \times v\sqrt{\frac{H}{h}}$$

As the pressure of steam employed in working an engine is usually estimated by the number of atmospheres, let n express the ratio between the common atmospherick pressure and the pressure D, then we shall have the head of pressure H = nh and, consequently,

$$V = \frac{O}{A} \times \frac{1}{3} v\sqrt{n}$$

the velocity with which the piston should travel per second to produce the greatest effect.

In uniform motions, the force being as the squares of the efficient velocity, we have D, the force answering to the least velocity, to D — R, the force answering to the velocity when the effect of the engine is a maximum, as $(1)^2$ is to $\left(\frac{2}{3}\right)^2$ whence $D - R = \frac{4}{9} D$ or $R = \frac{5}{9} D$.

At the starting of a steam engine it is known, that when the pressure on the piston preponderates, the engine moves with an accelerated motion, and continues so to move, until the action of the steam upon the piston has become so far diminished, by the increased velocity of the engine, that the power and resistance become equal. Hence we may consider D — R either as the effective force of the steam, or the load, &c. to which it is a counterpoise.

Let the effective force of the steam in a low pressure engine be taken at 10 lbs. per square inch, as in the former example; and suppose O : A :: 1 : 50, which is near the usual proportion; then the velocity of the piston when the effect of the engine is a maximum, will be

$$V = \frac{O}{A} \times \frac{1}{3} v\sqrt{n} = \frac{1}{50} \times \frac{1}{3} \times 644 \times \sqrt{\frac{10}{15}} =$$

3.36 feet per second on 201½ feet per minute.

Again, suppose the effective force of steam with which a high pressure engine is to work is equal to 60 lbs. per square inch; here $n = 4$, and supposing $\frac{O}{A}$ to be as before, we should have V =

$\frac{1}{50} \times \frac{1}{3} \times 644 \times 2 = 8.5$ feet per second, or 510 feet per minute, which would be at the rate nearly of 6 miles per hour.

Let $n = \frac{100}{15}$ or, that the engine works with an effective force equal to 100 lbs. per square inch, then $V = \frac{1}{50} \times \frac{1}{3} \times 644 \times \sqrt{\frac{100}{15}} = 11$ feet per second, or 660 feet per minute. Hence 100 lbs. × 660 = 66000 lbs. the momentum per square inch on the area of the piston.

In a former example we supposed an engine having the pressure on the safety valve equal to 150 lbs. per square inch, to work at the rate of 200 feet per minute only; hence putting

$$\sqrt{\frac{D-R}{D}} = \frac{200}{660}$$

we shall find R nearly equal to $\frac{10}{11}$ D, and consequently, we shall have answering to this case, 133 lbs. × 200 = 26600 lbs. the momentum per square inch on the area of the piston, which is nearly ⅓d less than when the engine carried a less load with a greater velocity. This comparison may suffice to show the advantage in attending to the proper adjustment of the load.

SWIFT SAILING.

An editorial article appeared in our last, on the subject of naval architecture, in reference to the building and sailing of boats. The experience of the past month, in the short passages of many of our ships engaged in the London, Liverpool and Havre trades, lead us again to recur to this

subject, in reference to ship building. The great object aimed at by our ship owners and ship builders has been, we believe, of late years, to combine the advantages of sailing and burden; and we think, from the immense quantity of merchandize taken out in a single ship, say to Liverpool, and the quantity of merchandize brought in return, and what has already been hinted at, to wit, the very short term in which a passage is made, all serve to show how completely this object has been accomplished. One ship, we are told, (the Liverpool,) arrived at this port from Liverpool, having been but three hundred and twelve hours from Cape Clear to the wharf in Boston! We also subjoin, as a matter of record, from the New-York Daily Advertiser, the following statement:

"SHORT ARRIVALS: 1830.—We have recorded below, a succession of short arrivals at this port, which we believe to be unparallelled in navigation, at least, from Europe to America. For the last three weeks the wind, we believe, without intermission, has prevailed from N. E. variable to E. S. E. but principally at N. E. The shortness of these trips will appear astonishing, when we consider that over thirty days is the yearly average of passages from Europe to New-York.

Vessels Names.	Where from.	Sailed.		Arrived.	
De Rham, - - -	The E. Channel,	March	25	April	11
Charlemagne, -	Havre, - - - - -	"	22	"	13
Hudson, - - - -	The Lizard, - -	"	26	"	13
Josephine, - - -	Belfast, - - - -	"	27	"	12
Wm. Thompson,	Liverpool, - - -	"	25	"	15
George Canning,	Liverpool, - - -	"	25	"	15
Concordia, - - -	Liverpool, - - -	"	25	"	15
Walter, - - - -	Liverpool, - - -	"	26	"	15
Admittance, - -	Rochelle, - - -	"	26	"	15
Jubilee, - - - -	Liverpool, - - -	"	29	"	16
Charles Joseph,	Liverpool, - - -	"	16	"	16
Columbia, - - -	Portsmouth, - -	April	1	"	17
Caledonia, - - -	Liverpool, - - -	"	1	"	17

Of the above vessels, whose passages have been extraordinarily short, that of the ship Josephine, Capt. Britton, stands the most conspicuous, she having performed her passage from Belfast to New-York, within fifteen days and twelve hours.

There have been two short arrivals at Boston; one, the ship Liverpool, which sailed from Liverpool on the 25th of March, and arrived at Boston on the 13th April; the other, the barque Unity, which sailed from Liverpool on 27th March, and arrived on 15th April.

COMMUNICATION.] [FOR THE MAGAZINE.

EARLY RISING.

MR. EDITOR,—If there are any persons so unfortunate that they have not yet set aside their winters' slothfulness, and still continue to resist the morning invitations of the season, we invite them to choose some fair day and make an experiment of that which a great proportion of their mechanick brethren are bound and obliged to make a practice. The habit of early rising throughout the year, if rigidly pursued, is perhaps, next to cleanliness, the foundation of good morals. It bears the same comparative rank in morals that truth does in virtue. For, as no man can be a very great knave who always tells the truth, so no one can be a great debauchee, or drunkard, or gambler, who pursues the system of early rising. There are exceptions, no doubt, to every rule; and such an exception may be supposed to be found in those who are said to rise up early to drink strong drink. But we consider the uneasiness of the drunkard in bed, which compels him to rise for his dram, as no more early rising than the thirst of the feverish invalid whom pain and sickness disturb throughout the night. It is hardly necessary to recommend early rising to mechanicks, for there are few whom the competition of the industrious will tolerate in that class, unless they are sedulous in their occupation day in and night out. One of the most inestimable privileges of the mechanick is his exemption from the midnight toil which wears upon the constitution and preys upon the spirits of the professional man. This exemption can be sustained only by the substitute of the morning hour. But all classes ought, for one season in the year, to *indulge* in early rising. The effeminate may excuse themselves in the depth of November, and in mid-winter, when the meridian sun fails to relieve the excessive cold; and even in summer, when the coolness of morning wafts a refreshing slumber to the exhausted frame. But now, when the year has renewed its youth, and is blossoming, as it were, in maiden beauty, what heart does not feel young, and what spirit is not refreshed by witnessing the glory and the power of the morning.

Franklin, the friend of the human race, was remarkable for his love of the morning; and keen as he was to discover real utility in every thing which accorded with good theories, remarked that "the sound of the hammer at five in the morning, heard by a

creditor, makes him feel easy six months longer."

I believe, Mr. Editor, that a man whose business is commenced early in the morning, need not be heard long by any creditor; for he will insensibly become punctual in all his dealings, and will be as ready to pay as he is to rise.

BOSTON SOCIETY FOR THE DIFFUSION OF USEFUL KNOWLEDGE.

At a meeting of the Board of Managers, held on the 28th of April, the following resolutions were passed, and it was ordered that they be published.

1. *Reso'ved*, That a premium in books be awarded to the several authors, being minors, of the three best Abstracts of the Lectures of the next session; the abstracts to be written in a fair hand, and to be delivered to the Recording Secretary within one month of the termination of the course of Lectures.

2. *Resolved*, That a premium in books be awarded to the author, being a minor, of the best Essay on any subject connected with Trade, Commerce, or Manufactures; the Essay to be delivered to the Recording Secretary before the first day of January, 1831.

3. *Resolved*, That the following Books be recommended to those members of the Society, who may seek any direction as to the matter and the course of their reading:

Hume's England; Scott's History of Scotland; Robertson's America; Marshall's American Colonies; Hutchinson's, Minot's and Bradford's Histories of Massachusetts; Snow's History of Boston; Gordon's American Revolution; Lee's Southern Campaigns; Marshall's Life of Washington; Irving's Columbus; Life of Franklin, James Otis, Patrick Henry, Josiah Quincy, Fulton, the Signers of the Declaration of Independence; 1st vol. of Malte Brun's Geography; Flint's Valley of the Mississippi; Paley's Natural Theology; Good's Book of Nature; Conversations on Vegetable Physiology and Elements of Botany; Ray's Conversations on Animal Economy; Stewart's and Brown's Philosophy of the Mind; Arnott's Elements of Physicks; Bigelow's Technology; Paley's Moral Philosophy; Ferguson on Civil Society; Blackstone's Commentaries; 1st vol. of Kent's Commentaries; Works of Alexander Hamilton; Everett's Europe and America; Say's Political Economy; Phillips on Insurance.

H. ROBINSON, *Rec. Sec'y.*

DAMP CELLARS.

Much complaint sometimes arises from those whose cellars are damp and mouldy, and the air disagreeable and unhealthy: that the dampness not unfrequently gets dispersed through all the lower parts of a house. A remedy is said to have been found by having a fire-place in the cellar, and which is done at a small extra expense when building; by which means, a free and constant circulation of air through the cellar is obtained. The writer has two houses in which there are fire-places in the cellars, and no complaint is made, as stated above, by those who occupy them.

RAIL-ROAD COMMUNICATION.

We notice that a new line of steam boats is to be established about this time, to run between Oswego, Rochester, Niagara, Kingston, (Upper Canada,) and Ogdensburg. The whole business of steam boat navigation on the lakes, and the St. Lawrence, is as active as is the business of the hundreds of stage coaches which continually are driving through the streets of our city. The very mention of the name of Ogdensburg reminds us of the Rail Road interest which is now attempting to be excited among us. This place is about three hundred and forty miles from Boston, and we hope to see the time when a direct line of Rail Road communication will be established between the two places.

BUILDINGS.

There is now preparations making for the erection of about two hundred dwelling houses in the city of Boston, this spring.

INQUIRY.

Sir,—Will some one of your correspondents inform me, through the medium of your publication, which are the best dictionaries of mechanical terms in the English language. I lose a great deal of useful knowledge from not understanding the technical terms which apply to the arts. If any one will take the trouble, he will much oblige

A Young Reader.

TO CORRESPONDENTS.

The writer of "Rumford" will confer a favour by calling at the office of the Magazine.

The solution of the "Mathematical Question," proposed in our last, was received too late for this number, but will appear in our next.

Errata....At p. 86, 1st col. 8th line from bottom, read wool instead of wood.